# Datex-Ohmeda

S/5™ Compact Anesthesia Monitor
S/5™ Compact Critical Care Monitor

Technical Reference Manual

All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

Intended purpose (Indications for use)

The Datex-Ohmeda S/5 Compact Anesthesia Monitor with L-CANE05 or L-CANE05A software is intended for multiparameter patient monitoring with optional patient care documentation.

The S/5 Compact Anesthesia Monitor with L-CANE05 or L-CANE05A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Bispectral index (BIS), Entropy (State Entropy and Response Entropy) and neurophysiological status of all hospital patients.

The S/5 Compact Anesthesia Monitor with L-CANE05 and L-CANE05A software when using BIS is for monitoring the state of the brain by data acquisition and processing of electroencephalograph signals and may be used as an aid in monitoring the effects of certain anesthetic agents.

The S/5 Compact Anesthesia Monitor with L-CANE05 or L-CANE05A software is also indicated for documenting patient care related information.

The S/5 Compact Anesthesia Monitor with L-CANE05 or L-CANE05A software is indicated for use by qualified medical personnel only.

The Datex-Ohmeda S/5 Compact Critical Care Monitor with L-CICU05 or L-CICU05A software is intended for multiparameter patient monitoring.

The S/5 Compact Critical Care Monitor with L-CICU05 and L-CICU05A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Bispectral index (BIS) and neurophysiological status of all hospital patients.

The S/5 Compact Critical Care Monitor with L-CICU05 and L-CICU05A software when using BIS is for monitoring the state of the brain by data acquisition and processing of electroencephalograph signals and may be used as an aid in monitoring the effects of certain anesthetic agents.

The S/5 Compact Critical Care Monitor with L-CICU05 and L-CICU05A software is indicated for use by qualified medical personnel only.

Classifications

In accordance with IEC 60601-1

Class I and internally powered equipment – the type of protection against electric shock.

Type BF or CF equipment. The degree of protection against electric shock is indicated by a symbol on each parameter module.

Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Continuous operation according to the mode of operation.

In accordance with IEC 60529

IPX1- degree of protection against harmful ingress of water.

In accordance with EU Medical Device Directive

The Datex-Ohmeda S/5 Compact Anesthesia Monitor is classified as IIb.

In accordance with CISPR 11:

Group 1, Class B

- Group 1 contains all ISM (industrial, scientific and medical) equipment in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.

- Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Responsibility of the manufacturer

GE Healthcare Finland Oy (GE) is responsible for the safety, reliability and performance of the product only if:

- modifications, service and repairs are carried out by personnel authorized by GE.
- the electrical installation of the room complies with appropriate requirements.
- the equipment is used in accordance with the User's Guide and serviced and maintained in accordance with the Technical Reference Manual.

Trademarks

Datex, Ohmeda, S/5, D-lite, D-lite+, Pedi-lite, Pedi-lite+, Mini D-fend, D-fend, D-fend+, OxyTip+, MemCard, ComWheel, EarSat, FingerSat, FlexSat, PatientO2, Entropy, Patient Spirometry and Tonometrics are trademarks of GE Healthcare Finland Oy. All other product and company names are property of their respective owners.

A portion of the Entropy software is derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

Datex-Ohmeda

S/5^{TM} Compact Anesthesia Monitor

S/5^{TM} Compact Critical Care Monitor

Technical Reference Manual, Order code: M1021567

Part I, General Service Guide

Document No.	Updated	Description	
M1031517-02		Introduction, System description, Installation, Interfacing, Functional check, General troubleshooting	**1**
M1031518-02		Planned Maintenance Instructions	**2**

Part II, Product Service Guide

Document No.	Updated	Description	
M1031519-01		CAM, CCCM Service Menu	**1**
M1031520-02		Display Unit for F-CM1, F-CMC1 rev. 00...04 F-CMREC1, F-CMCREC1 rev .00...02 Software Licenses L-CANE05(A), L-CICU05(A)	**2**
M1044470-01		Frame Unit for F-CM1, F-CMC1 rev. 00...04 F-CMREC1, F-CMCREC1 rev. 00...02 AC/DC Power Supply Unit	**3**
M1031521		Spare parts	**4**

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About this manual

Notes to the reader

This Technical Reference Manual is intended for service personnel and engineers who will install, service and maintain Datex-Ohmeda S/5 Compact Anesthesia Monitors running the software license L-CANE05 or L-CANE05A and S/5 Compact Critical Care Monitors running the software license L-CICU05 or L-CICU05A. As the monitor setup may vary, some functions described may not be available in the monitor you are using.

- The order code for the entire printed manual is M1021567. The manual includes Technical Reference Manual Slots and every slot has an individual document number.

- Part I gives the reader an overview of the monitor. It contains the information needed to install, interface and troubleshoot the monitors. Instructions for functional check and planned maintenance are also included. Read the manual through and make sure that you understand the procedures described before the installation of the monitor. To avoid risks concerning safety or health, strictly observe the warning indications. If you need any assistance concerning the installation, please do not hesitate to contact your authorized distributor.

- Part II contains detailed descriptions of each component of the S/5 CAM, CCCM Monitor,

For information of parameter modules, Remote Controller and Device Interfacing Solution refer to the "S/5 E-Modules, Technical Reference Manual". Service check for each of these products is included in these slots.

The manufacturer reserves the right to change product specifications without prior notice. Although the information in this manual is believed to be accurate and reliable, the manufacturer assumes no responsibility for its use.

Installation and service are allowed by authorized service personnel only.

GE Healthcare Finland Oy (GE) assumes no responsibility for the use or reliability of its software in equipment that is not furnished by GE.

Related documentation

S/5 Modules

S/5 E-Modules, Technical Reference Manual

S/5 M-Modules, Technical Reference Manual

S/5 Compact Anesthesia Monitor

For instructions for daily use including cleaning and daily maintenance, clinical aspects and basic methods of measurement see:
S/5 Compact Anesthesia Monitor, User's Guide
S/5 Compact Anesthesia Monitor, User's Reference Manual

S/5 Compact Critical Care Monitor

For instructions for daily use including cleaning and daily maintenance, clinical aspects and basic methods of measurement:
S/5 Compact Critical Care Monitors, User's Guide
S/5 Compact Critical Care Monitors, User's Reference Manual

For more information about the iCentral, S/5 Arrhythmia Workstation and anesthesia record keeping solution, see the "Technical Reference Manuals" and "User's Reference Manuals" for these products.

Software options and default settings are described in the "Default Configuration Worksheet" delivered with each monitor.

Available accessories are described in the "Supplies and Accessories" catalog delivered with each monitor.

Conventions used

To help you find and interpret information easily, the manual uses consistent text formats:

✍ Sign the check form after performing the procedure.

Hard Keys Names of the hard keys on the Remote Controller, Command Board, side panel and modules are written in the following way: **Others.**

Menu Items Software terms that identify window parts or menu items are written in bold italic: ***ECG Setup.*** Menu access is described from top to bottom. For example, the selection of the **Monitor Setup** hard key, the ***Screen 1 Setup*** menu item and the ***Waveform Fields*** menu item would be shown as **Monitor Setup** - ***Screen 1 Setup*** - ***Waveform Fields***.

'Messages' Messages (alarm messages, informative messages) displayed on the screen are written inside single quotes: 'Please wait'.

"Sections" When referring to different sections in this manual or to other manuals, manual names and section names are enclosed in double quotes:
See section "Cleaning and care."
Please refer to "iCentral User's Reference Manual: Alarms."

Hypertext links Hypertext links on PDF versions are written in blue color.

WARNING Warnings are written in the following way:

WARNING **This is a WARNING.**

CAUTION Cautions are written in the following way:

CAUTION This is a CAUTION.

NOTE Notes are written in the following way:

NOTE: This is a NOTE.

In this manual, the word "select" means choosing and confirming.

Illustrations and names

All illustrations in this manual are only examples, and may not necessarily reflect your system settings or data displayed in your system. If a particular selection is not available in your system, the selection is shown grayed.

1 Introduction

The modular design makes the system flexible and easy to upgrade. In addition to patient parameter modularity and easy upgrades, the monitor can be upgraded to anesthesia record keeping, wired and wireless networking and memory card operation. Additionally, external devices can be interfaced to the monitor with interface modules.

NOTE: Your system may not include all these components. Consult your local representative for the available components.
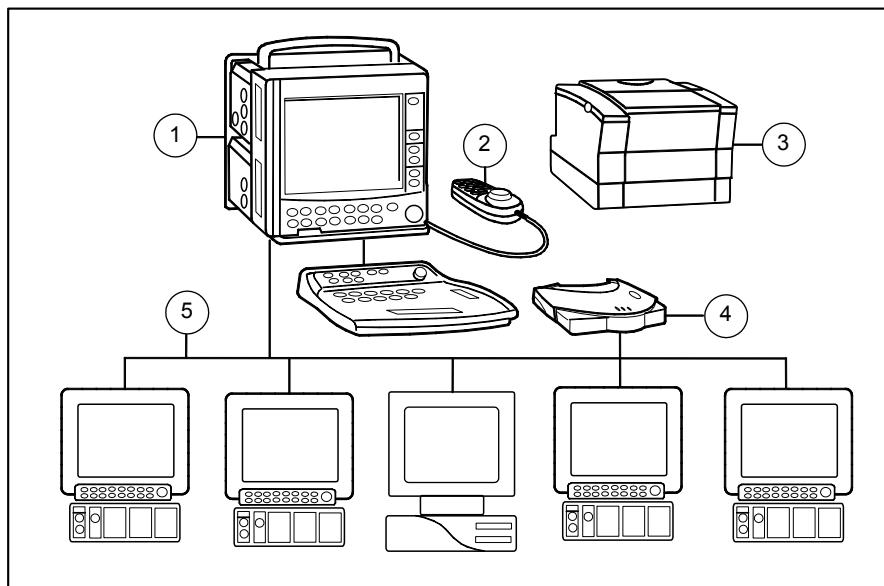
Figure 1   S/5 Compact Anesthesia Monitor system

(1)   S/5 Compact Anesthesia Monitor with modules inside

(2)   Remote Controller, K-CREMCO

(3)   Printer

(4)   Wireless Network (WLAN) Access Point, N-WAP

(5)   Network (LAN)

Optional components

Optional components are:

- Built-in recorder, N-CMREC1

- Remote controller

- Keyboard for anesthesia record keeping solution, barcode reader

- Wireless network option, N-CMW

Possible software options are:

- MemCard option, N-CMMEM

NOTE: Insert the WLAN PC card in the first slot from the front.

NOTE: Memory Module, M-MEM/ E-MEM, is not compatible with the S/5 Compact Monitors.

Communication between monitors

You can use the Compact Monitor as a stand-alone monitor or for

—   viewing and receiving data (alarms, vital signs) from other patient monitors

—   gathering and storing data during transportation.

To view other patient monitors, the monitor needs to be connected to the network (LAN or WLAN). To gather, store, and transfer data between different Datex-Ohmeda monitors, use memory cards or connect the monitor to the network.

NOTE: With WLAN, use only Data Card.

1.1 Symbols

1.1.1 Symbols on transport packaging

The contents of the transport package are fragile and must be handled with care.

Indicates the correct upright position of the transport package.

The transport package must be kept in a dry environment.
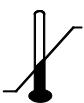
Indicates the temperature limitations within which the transport package should be stored.

1.1.2 Symbols on equipment

Ni-MH

This battery contains Ni-MH and can be recycled.

Dangerous voltage.

When using the ARK Barcode Reader, N-SCAN, do not stare into beam. The N-SCAN Barcode Reader is a Class 2 laser product.

1.1.3   Equipment safety symbols

- Attention, consult accompanying documents.
- When displayed next to the O2 value, indicates that the FiO2 low alarm limit is set below 21%.
- When displayed next to the HR value, indicates that the pacer is set on R.

- On the modules or frames indicates that modules with identical measurements should not be used in the same monitor. If such modules have been inserted, remove the module that has been most recently connected. You can also remove both modules and re-connect the new module after five seconds.

- On the Interface Module E-INT, M-INT, indicates that it is for connecting external devices. Do not connect patient cables to the module.
- On the E-TONO, M-TONO module indicates that the module should only be used with Tonometrics catheters.
- On the E-miniC module indicates that airway gases should be calibrated every six months in normal use and every two months in continuous use.

- BIS: On the Aspect DSC indicates that the converter must not be opened for any reason or autoclaved.

- On the E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, E-P, E-PP, E-PT, E-COP and E-COPSv module indicates that protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.

- On the E-NMT, M-NMT module indicates the following warnings:
  * Do not place the NMT stimulating electrodes on the patient's chest.
  * Always stop the NMT measurement before handling the stimulating electrodes.
  * Never subject a patient with an implanted electronic device to electrical stimulation without consulting a medical specialist first.

- On the rear or bottom panel this symbol indicates the following warnings and cautions:
  * Electric shock hazard. Do not open the cover or the back. Refer servicing to qualified service personnel.
  * For continued protection against fire hazard, replace the fuse only with one of the same type and rating.
  * Do not touch a battery-operated monitor during defibrillation procedure.
  * Disconnect from the power supply before servicing.
  * Do not use the monitor without manufacturer approved mounting attached.

Type BF (IEC 60601-1) protection against electric shock.

Type BF (IEC 60601-1) defibrillator-proof protection against electric shock.

Type CF (IEC 60601-1) protection against electric shock.

Type CF (IEC 60601-1) defibrillator-proof protection against electric shock.

When displayed in the upper left corner of the screen, indicates that the alarms are silenced. When displayed in the menu or digit fields, indicates that the alarm source has been turned off or alarm does not meet the alarm-specific activation criteria.

ESD warning symbol for electrostatic sensitive devices. Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures".

Symbol for non-ionizing electromagnetic radiation. Interference may occur in the vicinity of equipment marked with this symbol.

1.1.4   Other symbols

Equipotentiality. Monitor can be connected to potential equalization conductor.

Alternating current

Fuse. Replace the fuse only with one of the same type and rating.

SN, S/N   Serial Number

Battery operation and remaining capacity (green bar)

Battery charging (white bar)

Submenu. Selecting an alternative marked with this symbol in a menu opens a new menu.
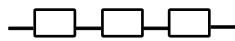
The monitor is connected to the network (LAN).

The monitor is connected to the wireless network (WLAN).

Data Card (green) and/or Menu Card (white) is inserted.

WLAN signal strength. The number of segments corresponds to the signal strength: four segments indicate strong signal, one segment weak signal. When connection to access point is being searched, the segments scroll from zero to four and back.

A blinking heart next to the heart rate or pulse rate value indicates the beats detected.

A lung next to the respiration rate value indicates that respiration rate is calculated from the impedance respiration measurement.

Gas inlet
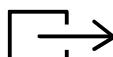
Gas outlet

Do not reuse.

Use by. Indicates the last use day.

Date of manufacture

Do not immerse the sensor in liquids.

IPX class:	Degree of protection against harmful ingress of water as detailed in the IEC 60529:
IPX0	- Ordinary equipment
IPX1	- Protection against vertically falling water drops.
IPX2	- Protection against vertically falling water drops when enclosure tilted up to 15 °.
IPX3	- Protected against spraying water.
IPX4	- Protected against splashing water.
IPX7	- Protected against the effects of temporary immersion in water.
IPX8	- Protected against the effects of continuous immersion in water.
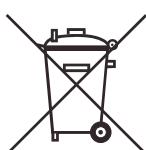
This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

Ethernet connector

1.2   Safety

The following list contains general warnings and cautions you should know before installing, maintaining or servicing the system. Warnings and cautions specific to the use of the system can be found in the User's Guide and User's Reference Manual.

1.2.1   Safety precautions

Warnings

WARNING   **A WARNING indicates a situation in which the user or the patient may be in danger of injury or death.**

Power connection

- Use only hospital-grade grounded power outlets and power cord. Do not remove the grounding pin from the power plug.

- Use only an intact power cord. Replace the power cord if it is cracked, frayed, broken or otherwise damaged.

- Do not apply tension to the power cord otherwise the cord may get damaged.

- Do not use extension cords or adapters of any type.

- Before starting to use the system, ensure that the whole combination complies with the international standard IEC 60601-1-1 and with the requirements of the local authorities. Do not connect any external devices to the system other than those specified.

- If the integrity of the external protective earth conductor arrangement is in doubt, use the monitor with battery operation.

- To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

- Do not use an additional multiple socket outlet or extension cord.

Installation

- Keep the monitor horizontal when the Compact Airway Module is used. Tilting the monitor may cause erroneous results in the Compact Airway Module's readings and damage the module.

- The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.

- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures"

- After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.

- Never install the monitor so that it is above the patient.

- A printer or computer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).

- If you accidentally drop the monitor, modules or frames, have them checked by authorized service personnel prior to clinical use.

Laser radiation

- When using the ARK Barcode Reader, N-SCAN, do not stare into the beam. The N-SCAN is a Class 2 laser product.

External connection

- Do not connect any external devices to the monitor other than those specified.

Fuse replacement

- Replace a fuse only with one of the same type and rating.

Explosion hazard

- Do not use the monitor in the presence of flammable anesthetics.

Patient safety

- Do not perform any testing or maintenance on the monitor while it is being used on a patient.

- PACEMAKER PATIENTS: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. In this case, set the pacemaker rate responsive mode off or turn the monitor impedance respiration measurement off.

- Never install the monitor so that it is above the patient.

- The monitor must not be used without manufacturer approved mounting attached.

- Operation of the monitor outside the specified values may cause inaccurate results.

Cleaning and service

- Only trained personnel with proper tools and test equipment should perform the tests and repairs described in this manual. Unauthorized service may void the monitor warranty.

- Turn the power off and unplug the power cord before cleaning or service. Completely remove any moisture before reconnecting the power cord to the mains outlet.

- Do not touch any exposed wire or conductive surface while any cover is removed and the monitor is energized. The voltages present can cause injury or death.

- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures".

- Always perform an electrical safety check and a leakage current test on the monitor after service.

Accessories

- Use only accessories, including mounts and batteries, and defibrillator-proof cables and invasive pressure transducers approved by GE Healthcare. For a list of approved supplies and accessories, see the "Supplies and Accessories" catalog delivered with the monitor. Other cables, batteries, transducers and accessories may cause a safety hazard, damage the equipment or the system, result in increased emissions or decreased immunity of the equipment or system or interfere with the measurement. Protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.

- Single use accessories are not designed to be reused. Reuse may cause a risk of contamination and/or affect the measurement accuracy.

Cautions

CAUTION   A CAUTION indicates a condition that may lead to equipment damage or malfunction.

Installation

- Leave space for air circulation to prevent the monitor from overheating.
- Before connecting the power cord to the power supply, check that the local voltage and frequency correspond with the rating stated on the device plate.

Before use

- Allow two minutes for warm-up and note any error messages or deviations from normal operation.
- Do not connect a sampling line to the female Patient Spirometry connector while the other end of the sampling line is connected to the D-fend water trap. The pressure in the gas sampling system may cause damage to the PVX unit pressure transducers.

Autoclaving and sterilizing

- Do not autoclave any part of the monitor.
- Do not gas sterilize the modules.

Cleaning and service

- Do not use hypoclorite, ammonia-, phenol-, or acetone based cleaners. These cleaners may damage the monitor surface.
- Do not immerse any part of the device in any liquid, or allow liquid to enter the monitor or modules.
- Do not apply pressurized air to any outlet or tubing connected to the monitor.
- Electrostatic discharge through the PC boards may damage the components. Before handling PC boards, wear a static control wrist strap. Handle all PC boards by their non-conductive edges and use anti-static containers when transporting them.
- Do not break or bypass the patient isolation barrier when testing PC boards.
- Do not clean the spirometry tubes with high pressure air or O2 flushing while the spirometry tubes are connected to Patient Spirometry connector. High differential pressure may damage PVX unit pressure transducers.

Special components

- Special components are used in these monitors that are vital to assure reliability and safety. GE Healthcare assumes no responsibility for damage, if replacement components not approved by GE Healthcare are used.

- A lithium battery on the CPU Board. Dispose of the faulty IC containing the battery according to local regulations.

Batteries

To replace the batteries safely, please refer to the service instructions in this manual.

- Do not short-circuit the battery terminals, this may produce a very high current, which will damage the battery.

- Do not dispose of the battery into open flame, nor put the battery near fire, as it may explode.

- Do not dismantle the battery.

See also section "Symbols".

Storage and transport

Do not store or transport the monitor outside the specified temperature, pressure and humidity ranges:

Temperature	-10...+50 °C/14...122 °F
Atmospheric pressure	660...1060 hPa/500...800 mmHg/660...1060 mbar
Relative humidity	10...90% noncondensing

For display specific environmental requirements see specifications in the "Display" slot.

1.2.2 ESD precautionary procedures

- To avoid electrostatic charges building up, it is recommended to store, maintain and use the equipment at a relative humidity of 30% or greater. Floors should be covered by ESD dissipative carpets or similar. Non-synthetic clothing should be used when working with the component.

- To prevent applying a possible electrostatic discharge to the ESD sensitive parts of the equipment, one should touch the metallic frame of the component or a large metal object located close to the equipment. When working with the equipment and specifically when the ESD sensitive parts of the equipment may be touched, a grounded wrist strap intended for use with ESD sensitive equipment should be worn. Refer to the documentation provided with the wrist straps for details of proper use.

ESD precautionary procedure training

It is recommended that all potential users receive an explanation of the ESD warning symbol and training in ESD precautionary procedures.

The minimum contents of an ESD precautionary procedure training should include an introduction to the physics of electrostatic charge, the voltage levels that can occur in normal practice and the damage that can be done to electronic components if they are touched by an operator who is electrostatically charged. Further, an explanation should be given of methods to prevent build-up of electrostatic charge and how and why to discharge one's body to earth or to the frame of the equipment or bond oneself by means of a wrist strap to the equipment or the earth prior to making a connection.

1.2.3 Disposal

Dispose of the whole device, parts of it and its packing material in accordance with local environmental and waste disposal regulations.

2   System description

2.1   Introduction

Datex-Ohmeda monitors build up a freely configurable modular system. The architecture is designed to enable different module combinations so that the user is able to get the desirable parameter and feature set. This modular approach makes it possible to add new features when they are needed.

2.2   Bus structure
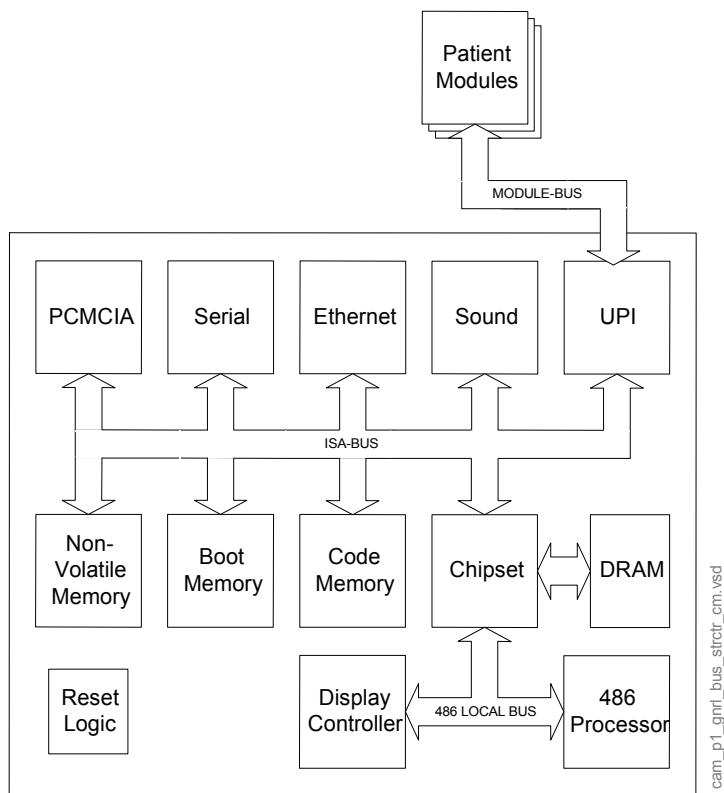
Figure 2   General bus structure of S/5 system

The CPU bus is a communication channel used only for internal data transfer. It is based on the ISA bus used in IBM PC computers. Data is transferred on this 16 bit wide bus using the CPU clock frequency.

The module bus is for the parameter modules. The bus is based on the industry standard RS-485, which uses a differential serial method to transfer data. This type of bus is robust and it allows parameter modules to be inserted or removed while the power is on. The module bus uses a 500 kbps data transfer rate.

The RS-485 type of serial communication supports so-called multidrop or party line connections. This means that all parameter modules connected to the module bus use exactly the same lines for communication. The advantage of this is that all bus connectors are identical and the modules can be connected in any order and position.

2.3 Distributed processing

A system assembled from S/5 products is a multiprocessor system. All parameter modules have their own microprocessor, which performs functions such as module key control, waveform filtering, parameter related computing and pneumatic control, etc. At the same time the main CPU performs higher level tasks such as trending and alarm control. While the parameter modules and CPU are performing their tasks, the UPI (Universal Peripheral Interface) microprocessor handles all functions needed to transfer data between the parameter modules and the CPU.

This kind of parallel processing gives one major advantage to centralized processing. When new parameter modules are added to the system, the processing power is increased. As a result, the system does not slow down when new features are added.

2.4 Module communication

The communication master controlling data transfers between the CPU and parameter modules is called UPI processor. It sends data to each connected module 100 times a second. Modules respond to each data request immediately by sending a data package, whose length depends on the type of the module. This communication protocol ensures that each module receives and sends data every 10 ms. If a module does not respond to data requests, the UPI processor presumes that the module is disconnected.

Parameter modules may hold a static (fixed) or dynamic address, which the UPI processor uses when sending out data. Two parameter modules of the same type must not be fitted onto the same monitor since they might reply to a data request simultaneously, thus causing communication errors.
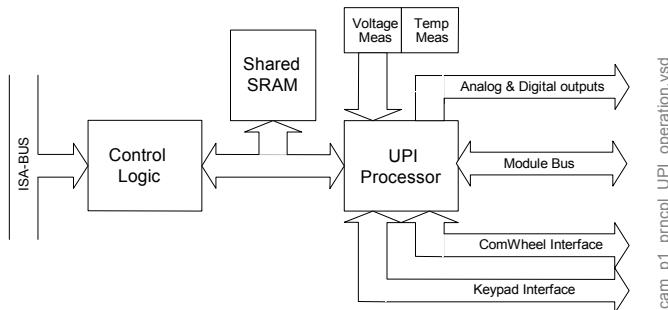
Figure 3   Principle of UPI section operation

The UPI processor collects and stores all data that is received from the parameter modules into a shared SRAM, which is mapped directly to the address space of the main CPU. The main CPU reads data from the memory while the UPI processor guarantees that the data is up to date. This operation also works in the other direction. In this the main CPU fills the shared SRAM with data and the UPI processor distributes it to the parameter modules.

2.5 Software loading

The program memory on the CPU board is loaded with monitor software at the factory. The software is used for running all the functions that are integrated into the PC board. For service and upgrade procedures, the CPU board is fitted with a PCMCIA card drive through which new software can be loaded.

2.6 Parameter modules
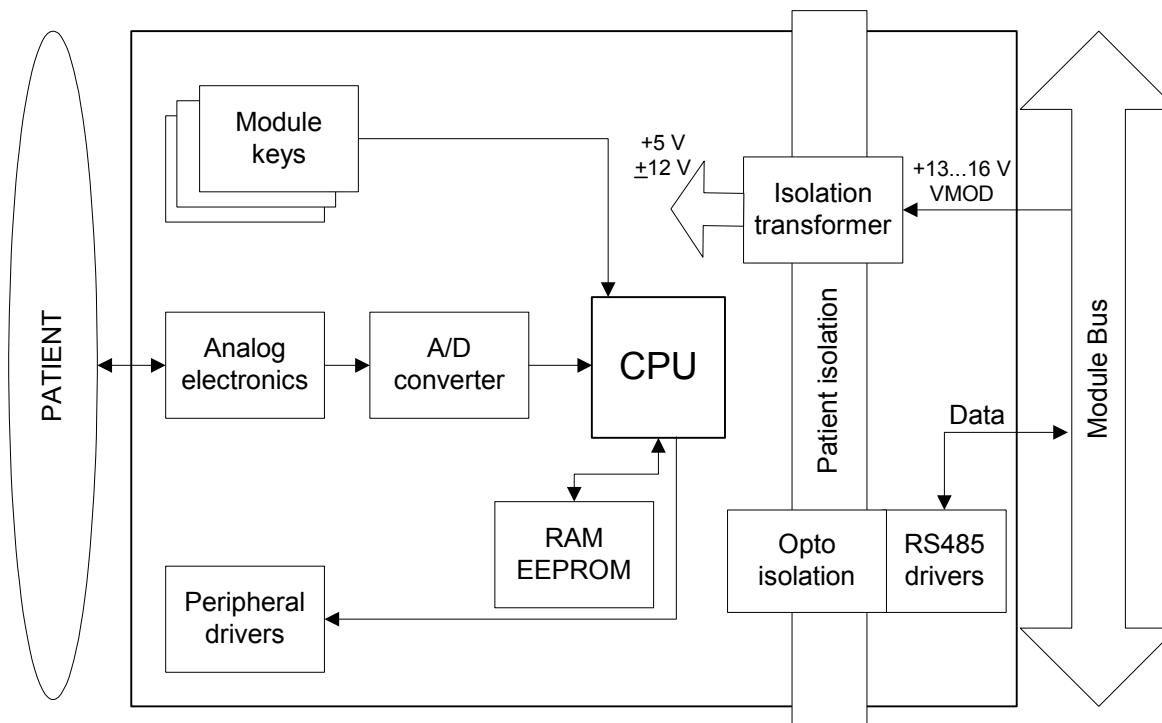
Figure 4   **General structure of parameter modules with patient isolation**

The detailed structure of a parameter module depends on the specific needs for each individual parameter. However, some common parts are used in the parameter modules. The electronics inside the module is usually divided into isolated (floating) and non-isolated sections. Typically, the non-isolated section consists of buffers to interface the parameter module to the module bus while the rest of the electronics is located in the isolated section. The isolated section includes the microcontroller together with memory components, the front-end analog electronics (amplifiers, etc.) and sensor drivers.

3   System installation

3.1   Unpacking instructions

1. Confirm that the packing box is undamaged. If the box is damaged, contact the shipper.
2. Open the top of the box and carefully unpack all components.
3. Confirm that all components are undamaged. If any of the components are damaged, contact the shipper.
4. Confirm that all components are included. If any of the components are missing, contact your GE Healthcare distributor.

3.2   Choosing location

Consider the following aspects:

- lighting
- space
- connections
- electromagnetic and radio frequency interference, see Appendix B. ElectroMagnetic Compatibility
- environment

WARNING   **The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.**

WARNING   **Never install the monitor so that it is above the patient.**

CAUTION   The monitor display is fragile. Ensure that it is not placed near a heat source or exposed to mechanical shocks, pressure, moisture or direct sunlight.

3.3   S/5 Frame for Compact Monitor

Mounting of S/5 Compact Monitor to the Bed Mount, Wall Mount or Roll Stand is described in a separate instruction sheet delivered with each mount.

WARNING   **After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.**

3.3.1 Compact Monitor connections
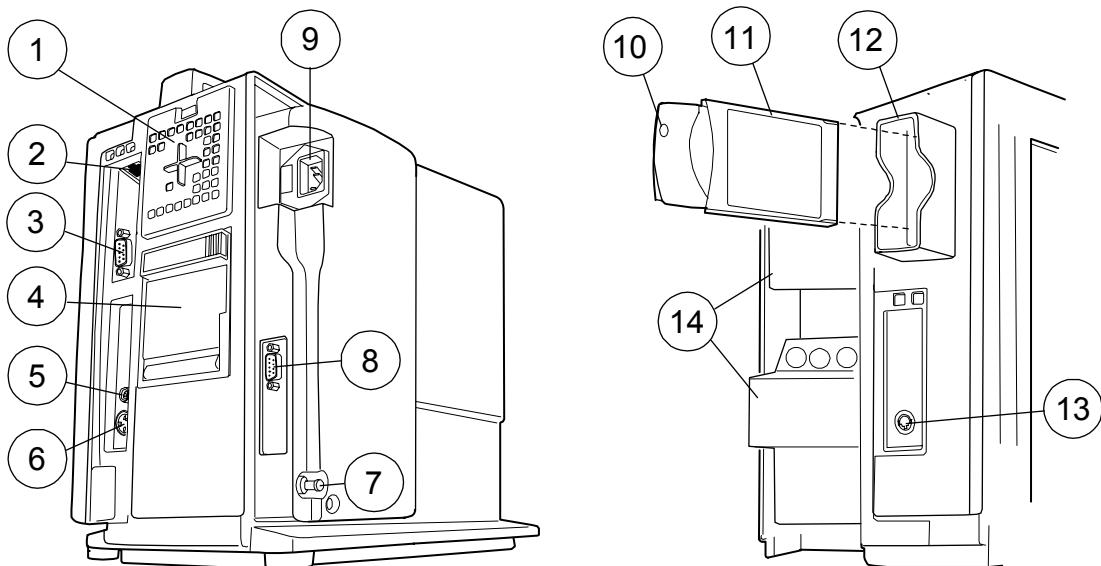
Figure 5   **External connections of Compact Monitor frame F-CM(C)1 rev.04**

(1)   Air filter

(2)   NET connector

(3)   NET ID connector (not used with N-CMW)

(4)   Recorder (optional)

(5)   SYNC connector

(6)   Connector for external keyboard (anesthesia record keeping solution keyboard), K-CREMCO or Barcode Reader

(7)   Potential equalization

(8)   Serial port

(9)   Receptacle for power cord

(10) WLAN PC card LED

(11) WLAN PC card

(12) Slot for Memory Cards (PCMCIA) and WLAN PC card

(13) Connector for Device Interfacing Solution

(14) Modules

NOTE: Insert the WLAN PC card in the first PC card slot from the front.
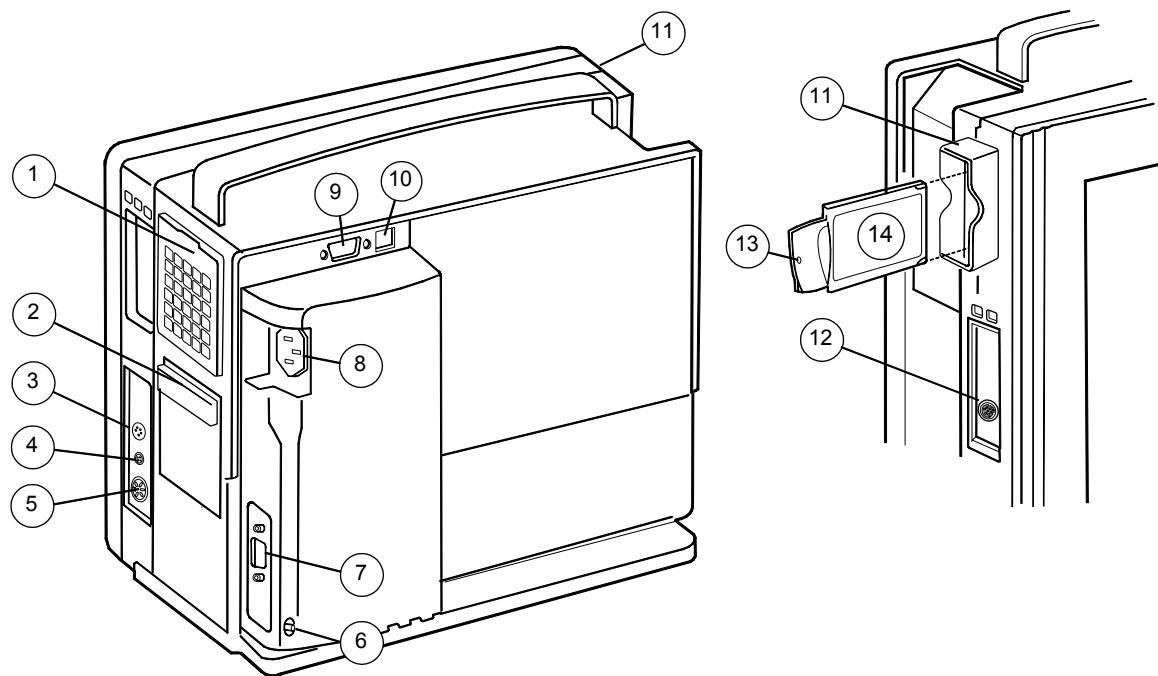
Figure 6   External connections of Compact Monitor frame F-CM(C)1 rev.00…03

(1)   Dust filters

(2)   Recorder unit (optional)

(3)   Connector for factory use only

(4)   Synchronization connector

(5)   Connector for external keyboard (anesthesia record keeping solution keyboard), K-CREMCO or Barcode Reader

(6)   Potential equalization connector

(7)   Serial port connector

(8)   Receptacle for power cord

(9)   NET ID connector

(10) NET connector

(11)   WLAN antenna cover (optional)

(12) Connector for Device Interface Solution

(13) WLAN antenna card LED

WLAN antenna card (optional)

CAUTION   Switch the power to standby before making any connections.

3.3.2   Connecting to mains

Connect the power cord to the mains power inlet on the side of the power supply unit and to the wall socket.

NOTE: Before taking the monitor into use for the first time, the batteries should be fully charged. Keep the monitor connected to the mains until the Battery charging symbol disappears, or in STBY mode the Stby LED stops blinking (may take up to 10 hours if the batteries are fully discharged).

WARNING   **The power cord may only be connected to a three-wire, grounded, hospital grade receptacle.**

3.3.3   Connecting to Network

Make sure that the Datex-Ohmeda Network Option, N-CMNET or S/5 MemCard and Network Option, N-CMMEM is installed.

NOTE: With L-CANE03(A) and L-CICU03(A) or newer software, the N-CMNET option is automatically installed.

Use the Monitor-Network cable to connect the monitor to the network.

1.   Make sure that the power is switched off.

2.   Connect the Identification Plug and one RJ-45 connector to the connectors X4 and X5.

3.   Connect the other RJ-45 connector to the corresponding connector on the wallbox.

4.   Switch on the power. Confirm that the network symbol and 'Connected to Network' message are displayed on the upper part of the screen.

3.3.4   Connecting to Wireless Network

Make sure that the S/5 Wireless LAN Option, N-CMW and the antenna cover are installed. Use the wireless LAN antenna card to connect the monitor to the network.

NOTE: The N-CMW option requires also that either N-CMNET or N-CMMEM option is installed.

1.   Make sure that the power is switched off.

2.   Connect the wireless LAN antenna card into the foremost card drive slot.

3.   Switch on the power. Confirm that the wireless LAN network symbol and the wireless LAN signal strength symbol are displayed on the upper part of the screen.
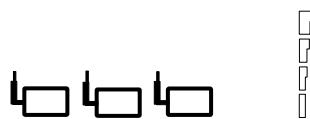
3.3.5   Inserting the parameter modules

Insert each plug-in parameter module into a module slot. Firmly press the module in position.

NOTE: Ensure that the module is properly oriented (i.e. the module release latch is facing downward). Do not use two or more modules with identical functions in the monitor.

Modules with identical functions are:

- Hemodynamic multiparameter modules, E-PRESTN, E-PRETN, E-RESTN, M-PRESTN, M-PRETN, M-RESTN, M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR, M-NESTR, M-NE12STPR, M-NE12TPR, M-NE12STR

- Pressure Modules, E-P/ M-P, Pressure Temp Module, E-PT/ M-PT

- Cardiac Output Modules, E-COP, E-COPSv, M-COP and M-COPSv

- NIBP Modules, M-NIBP and hemodynamic multiparameter modules w/ N measurement

- Compact Airway Modules, E-CO, E-COV, E-COVX, E-CAiOVX, E-CAiOV, E-CAiO, M-C, M-CO, M-COV, M-CAiO, M-CAiOV, M-CAiOVX, Single-width Airway Modules M-miniC, E-miniC

- The Recorder Module, E-REC/M-REC and the built-in recorders in F-CMREC1 or F-CMCREC1 and U-CMREC1 or N-CMREC1

3.3.6   Downloading Monitor Software

The following instructions apply to downloading of new monitor software in case of upgrade or service. Detailed instructions for downloading software are supplied with software PCMCIA cards.

NOTE: All user settings will be lost after downloading of new monitor software.

NOTE: During the downloading of software, the serial number of the monitor is written on the software card. The software can then be downloaded again onto the same monitor, but not onto any other monitor.

1. Make sure that the monitor is switched to standby.
2. Press and hold the service reset button on the rear panel for at least five seconds or until the service reset indicator LED turns off.
3. Open the cover for card drive slots, if installed. Insert the software card into one of the card drive slots and press the software card firmly in position.
4. Make sure that at least 30 seconds have passed since the service reset, then switch the monitor on.
5. Wait for approximately 80 seconds. After the start-up screen appears, enter the Service View and make sure that the information regarding monitor software has been updated. Memorize the serial number of new software.
6. Remove the software card.
7. Replace the original device plate for monitor software by the new one supplied with the software card.
8. Perform Factory Reset, see "Performing Factory Reset" . Make sure that the monitor functions normally after the restart.
9. Set the time and date.

10. Set the monitor's network communication according to the network software in use, if necessary. Enter the service menu: **Monitor Setup -Install/Service (16-4-34) - Service (26-23-8)- Frame - Network- Config** and set

   - Network software S-CNET99 -> DRI Level = 1999
   - Network software S-CNET01 -> DRI Level = 2001
   - Network software S-CNET02 -> DRI Level = 2001 or 2002 (WLAN)
   - Network software L-NET03 -> DRI Level = 2003
   - Network software L-NET05 -> DRI Level = 2005

NOTE: The DRI level 1999 is not selectable in all monitor software versions.

NOTE: If the DRI level is changed, the monitor will restart automatically.

11. Fill out all necessary documentation regarding the new monitor software.

NOTE: The license agreement of monitor software needs to be in accordance with the monitor software serial number. Make sure you archive the license agreement in a secure location.

NOTE: The first start-up after software loading takes considerably longer.

3.3.7   Performing Factory Reset

NOTE: The factory reset is necessary after replacing monitor software.

NOTE: The factory reset will restore all customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.
2. Select **Install/Service** and password (16-4-34).
3. Select **Service** and password (26-23-8).
4. Select **Set/ Test** and **Factory Reset**.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually.

3.3.8   Installing the Datex-Ohmeda Network and MemCard Upgrade, U-CMMEM

The following instructions apply to upgrading the monitor with both the MemCard and the Network options. Detailed upgrade instructions are supplied with the corresponding upgrade product.

NOTE: You can download the option software only onto one monitor. During the downloading of option software, the serial number of the monitor is written on the software card, and if the downloading for some reason would fail, the software can be downloaded again onto the same monitor, but not onto any other monitor.

1. Make sure that the monitor is switched to standby.
2. Detach the cover plate on the network connectors at the rear of the frame unit (above the power supply unit). Leave the collar on the connectors attached.
3. Open the cover for card drive slots (on the left side of the monitor). Insert the option software card into one of the card drive slots and press the software card firmly in position.
4. Switch the monitor on.

5. Wait until the normal screen appears and check that a message 'Field upgrade OK' is displayed as a note of successful upgrade.

6. Remove the option software card.

7. Enter the service menu and make sure that both options were loaded (***Monitor Setup -Install/Service - Service - Frame - Options - "Net+DC"***).

8. Install the device plate for option software on inside the cover for card drive slots. Close the cover.

9. Test the monitor with a MemCard and by connecting it to Datex-Ohmeda Network.

10. Fill out all necessary documentation regarding the upgrade.

3.3.9 Installing the Datex-Ohmeda Network Upgrade, U-CMNET

The following instructions apply to upgrading the monitor with the Network option. Detailed upgrade instructions are supplied with the corresponding upgrade product.

NOTE: You can download the option software only onto one monitor. During the downloading of option software, the serial number of the monitor is written on the software card, and if the downloading for some reason would fail, the software can be downloaded again onto the same monitor, but not onto any other monitor.

1. Make sure that the monitor is switched to standby.

2. Detach the cover plate on the network connectors at the rear of the frame unit (above the power supply unit). Leave the collar on the connectors attached.

3. Open the cover for card drive slots (on the left side of the monitor). Insert the option software card into one of the card drive slots and press the software card firmly in position.

4. Switch the monitor on.

5. Wait until the normal screen appears and check that a message 'Field Upgrade OK' is displayed as a note of successful upgrade.

6. Remove the option software card.

7. Enter the service menu and make sure that the option was loaded (***Monitor Setup -Install/Service - Service - Frame - Options - "Net"***).

8. Install the device plate for option software on inside the cover for card drive slots. Close the cover.

9. Test the monitor by connecting it to Datex-Ohmeda Network.

10. Fill out all necessary documentation regarding the upgrade.

3.3.10 Installing the S/5 Wireless LAN Upgrade, U-CMW

The following instructions apply to upgrading the monitor with the Wireless LAN option. Detailed upgrade instructions are supplied with the corresponding upgrade product.
You can download the option software only onto one monitor. During the downloading of option software, the serial number of the monitor is written on the software card, and if the downloading for some reason would fail, the software can be downloaded again onto the same monitor, but not onto any other monitor.

1. Make sure that the monitor is switched to standby.

2. Open the cover for card drive slots (on the left side of the monitor). Insert the option software card into one of the card drive slots and press the software card firmly in position.

3. Switch the monitor on.

4. Wait until the normal screen appears and check that a message 'Field Upgrade OK' is displayed as a note of successful upgrade.

5. Remove the option software card.

6. Switch the monitor to standby.

7. Detach the cover for card drive slots and install the antenna cover.

8. Insert the wireless LAN antenna card into the foremost card drive slot.

9. Switch the monitor on.

10. Enter the service menu and make sure that the option was downloaded successfully (***Monitor Setup - Install/Service - Service - Frame - Options - "WLAN" or "All"***).

11. Enter the WLAN service menu and enter appropriate Network ID, WEP Algorithm, Key ID and Encryption Key information (***Monitor Setup - Install/Service - Service - Frame - Network - WLAN - WLAN Config***).

12. Check all installed options on the monitor software device plate and attach the Virtual ID sticker under the device plate at the monitor rear panel.

13. Test the monitor on Datex-Ohmeda Network.

14. Fill out all necessary documentation regarding the upgrade.

3.3.11 Installing the S/5 Recorder Upgrade, U-CMREC1

NOTE: Only S/5 Compact Anesthesia Monitor rev. 02 or later and S/5 Compact Critical Care Monitor rev. 02 or later can be upgraded with this S/5 Recorder Upgrade kit.

1. Turn the monitor off.
2. Disconnect the power cord.
3. Push the Service Reset button for at least 5 seconds until the service reset indicator LED turns off (the fan should turn off).
4. Remove the plate that covers the recorder installation place in the side panel.
5. Open the recorder (by pressing the button on the right upper corner at the front of the recorder).
6. Insert the recorder from outside to the side panel (opening button upwards).
7. Attach the recorder to the side panel with two screws at the back of the recorder (the screws can be accessed inside the recorder).
8. Check that the recorder and the side panel are aligned and the recorder tightly attached.
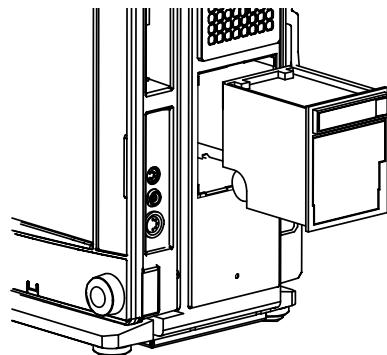
Figure 7   Installation of the U-CMREC1

9. Attach the device plate to the back cover of the monitor, near the other device plates.

3.4   S/5 Remote Controller, K-CREMCO

To connect S/5 Remote Controller, K-CREMCO, to an S/5 Compact Monitor:

1.   Make sure that the monitor is switched to standby.

2.   Connect the K-CREMCO to the 5-pin DIN connector X9 that is located on the right side of the Compact Monitor display unit.

3.5   Anesthesia Record Keeping Keyboard, K-ARKB

To connect Anesthesia Record Keeping Keyboard, K-ARKB, to an S/5 Compact Monitor:

1.   Make sure that the monitor is switched to standby.

2.   Connect the K-ARKB with an appropriate cable to the 5-pin DIN connector X9 that is located on the right side of the Compact Monitor display unit.

3.6   ARK Barcode Reader, N-SCAN (optional)

3.6.1   Connection to Compact Monitor

1.   Make sure that the monitor is switched to standby.

2.   Connect the N-SCAN with an appropriate cable to the 5-pin DIN connector X9 that is located on the right side of the Compact Monitor display unit.
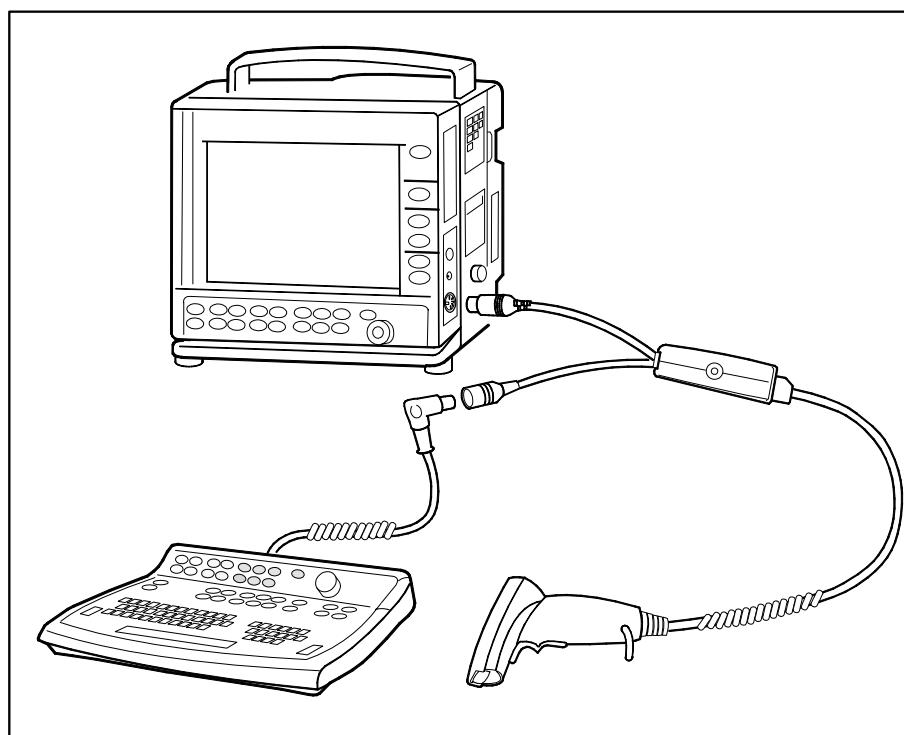
Figure 8   ARK Barcode Reader, N-SCAN connected to Compact Monitor

3.7   S/5 Compact Airway Modules, E-xxxx / M-xxxxx

This chapter provides information for installing Compact Airway Modules E-xxxxx.
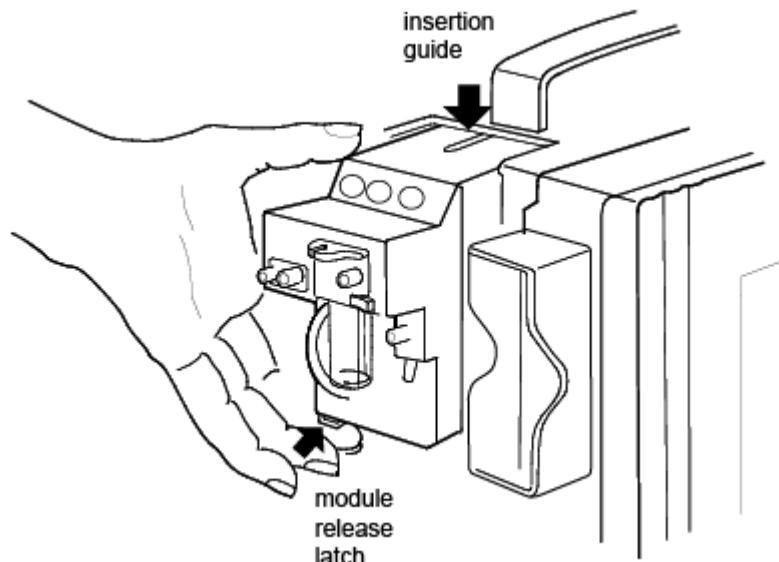
Figure 9   Compact Airway Module, E-XXXX

Connection to frame

1.   Ensure that the module is properly orientated (i.e. module release latch facing downward).
2.   Align the module insertion guide slot with the insertion guide.
3.   Push the module into the frame until it clicks.

3.7.1   Sample gas exhaust

Preventing operation room pollution

When N_2O or volatile anesthetics are used, pollution of the operation room by these gases should be prevented. Connect the sample gas outlet of the monitor to the scavenging system or return it to the patient circuit.

NOTE: The sample gas from the E-miniC/ M-miniC can only be connected to the scavenging, not returned to the patient circuit.

Connect the sample gas outlet of the monitor to the scavenging system either

- through the ventilator, or
- directly to the vacuum scavenging system.

CAUTION   Strong scavenging suction may change the operating pressure of the Airway Module and cause inaccurate readings or internal damage. To prevent this, there must for example be an opening to room air.

Connect the sample gas outlet only to an open scavenging system where gas is removed in room pressure.

Scavenging through the ventilator reservoir
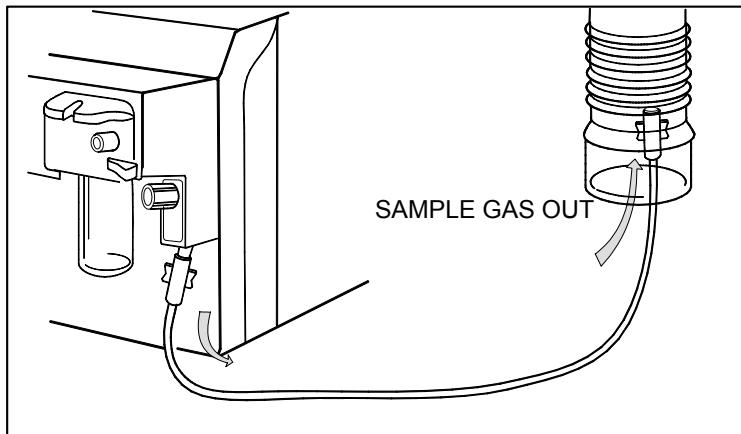
Figure 10   Scavenging through ventilator reservoir

1. Connect an exhaust line to the sample gas outlet on the module's front panel.
2. Attach the other end of the line to the ventilator reservoir. Make sure that the reservoir tube diameter is at least 2 - 3 times larger than the exhaust line.

Scavenging through the anesthesia gas scavenging system

Anesthesia machines are equipped with an anesthesia gas scavenging system (AGSS), and in some machines the sample gas outlet can be connected directly to that.

For example, connect the sample gas outlet to the S/5 Avance:
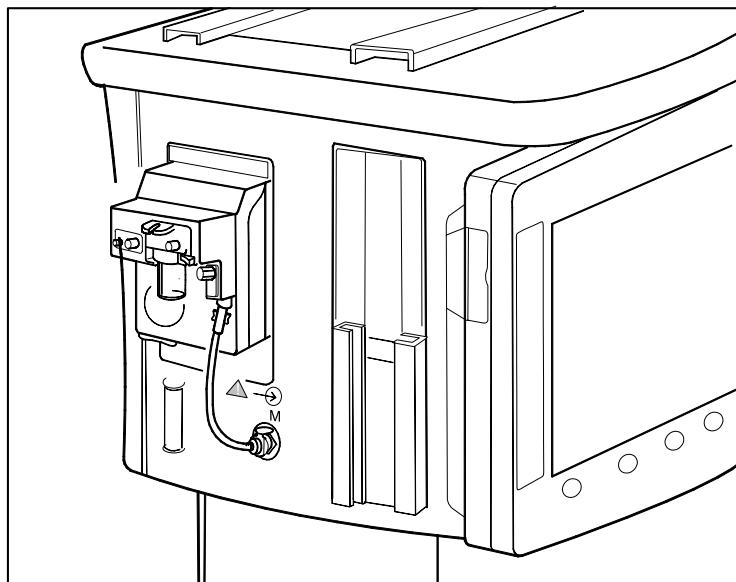
Figure 11   Connecting the gas module to the scavenging connector of S/5 Avance

NOTE: Refer to the anesthesia machine's documentation to find out where and how the sample gas can be connected.

Connecting directly to the vacuum scavenging system

1. Connect the exhaust line to the monitor's sample gas outlet.
2. Connect the exhaust line only to an open scavenging system where gas is removed at room pressure. Do not connect the monitor directly to a vacuum scavenging system.

Returning sampling gas to the patient circuit

The sampling gas can also be returned to the patient circuit. If you use the S/5 Anesthesia Delivery Unit (ADU), you need an optional adapter connected to the patient breathing tubes.

Take special care when returning sample gas to the patient circuit. For further information, please contact your GE Healthcare distributor.

NOTE: If E-miniC is being used, do not return the sample gas to the patient circuit.
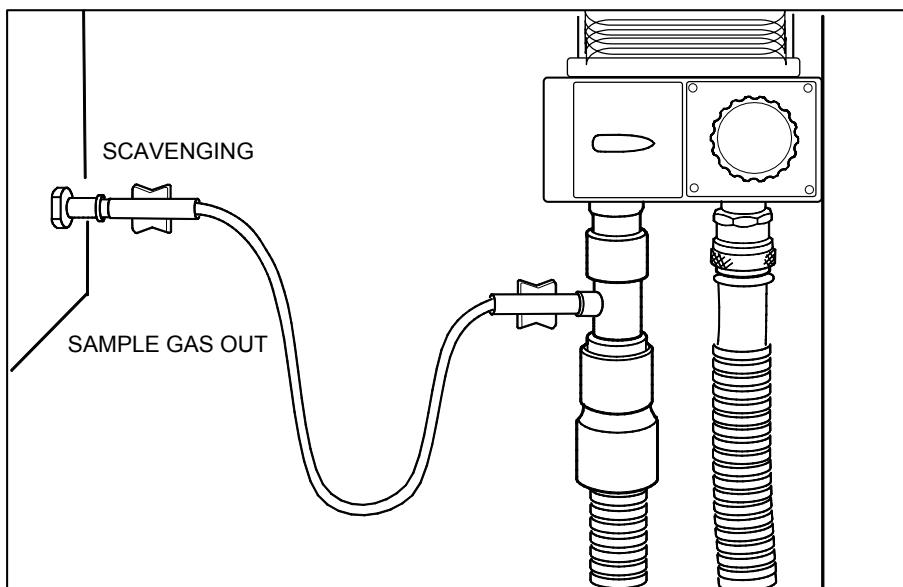
Figure 12   Sample gas returned to patient circuit in ADU

3.7.2 Troubleshooting

If a problem occurs during a functional examination, check the components of the monitor according to the following troubleshooting chart. If the problem persists, please refer to Part II of this Technical Reference Manual.

Trouble	Treatment
Nothing functions.	Unplug and re-plug Remote Controller Cable. Also confirm that the cable is intact. Unplug and re-plug the Power Cord. Also confirm that the cable is intact. Confirm that the fuses are intact.
A plug-in module does not function.	Remove and replace the module. Confirm that the desired parameters are configured to be displayed.
Compact Airway Module does not function.	Confirm that 'Occlusion' or 'Calibrating Gas Sensor' messages are not displayed. Confirm that a D-fend water trap and a sample tube are attached. Confirm that the desired parameters are configured to be displayed. Remove and replace the module.

For your notes:

4   Interfacing

External devices can be interfaced with the S/5 Compact Anesthesia and S/5 Compact Critical Care Monitors via the Compact Monitor's serial port, via the Interface Module, E-INT / M-INT, and via the Device Interfacing Solution, N-DISxxx.

The serial port can be used for interface with:

- S/5 Anesthesia Delivery Unit
- Printers
- Computers

An E-INT / M-INT can be used for interface with:

- Datex-Ohmeda monitors
- Various other manufacturers' monitors
- Various anesthesia machines

Printers and computers can be interfaced via the monitor's serial port.

Device specific N-DISxxx modules can be used with:

- Ventilators/ anesthesia machines
- Heart-lung machines
- Monitors
- Blood-gas analyzers

4.1   Interfacing external monitors via Interface Module, E-INT / M-INT

It is possible to interface Datex-Ohmeda monitors, Critikon Dinamap 1846SX, Abbott Oximetrix 3, Baxter Explorer and Vigilance, Nellcor N-100, N-200 and N-1000 to the S/5 Compact Anesthesia Monitor or to the S/5 Compact Critical Care Monitor via Interface Module, E-INT / M-INT. The parameters that are transferred from external monitors are summarized in tables: Table 1 Transference of parameters, Datex-Ohmeda monitors and Table 2 Transference of parameters, external monitors.

The Interface Module, E-INT / M-INT, has two serial/analog connectors (X7 and X8).

WARNING   **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Table 1   Transference of parameters, Datex-Ohmeda monitors

Device	Waveforms (analog)	Numerics	Alarms
Cardiocap	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate	None
Capnomac Capnomac II	E-INT / M-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate	None
Capnomac Ultima	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate, Spirometry, SpO_2, Pulse rate, Pleth amplitude	CO_2, O_2, Anesthesia agent, Respiration rate, Apnea, Occlusion, SpO_2, Pulse rate
Normocap 200 Normocap 200 OXY	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate	None
Oscar Oscar II Oscar OXY	E-INT / M-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate, Pleth amplitude	None
Satlite Satlite II Satlite Plus	E-INT / M-INT -> CO_2	SpO_2, Pulse rate, Pleth amplitude	None
Satlite Trans	None	SpO_2, Pulse rate, Pleth amplitude	None

Table 2   Transference of parameters, external monitors

Device	Waveforms	Numerics	Alarms
Critikon Dinamap 1846SX	None	NIBP	None
Abbott Oximetrix 3	None	SvO_2/SaO_2, CO	None
Baxter Explorer	None	C.O., SvO_2, REF, Tblood	None
Baxter Vigilance	None	C.O., SvO_2 C.C.O., Tblood	None
Nellcor N-100 N-200 N-1000	Pleth (analog)	SpO_2, Pulse rate	None

4.1.1   Connection to external Datex-Ohmeda monitors

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.

2. Connect the 9 pin D-connector to one of the connectors on the Interface Module, E-INT / M-INT. Tighten the finger screws.

3. Connect the 25 pin D-connector to the corresponding connector on the other monitor. Tighten the finger screws.

4.1.2 Connection to Critikon Dinamap 1846SX, Abbott Oximetrix 3 and Baxter Explorer

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to one of the connectors on the Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to the connector on the external monitor. Tighten the finger screws.

4.1.3 Connection to Baxter Vigilance

Use the INT-Baxter Vigilance Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to one of the connectors on the Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the other 9 pin D-connector to a corresponding connector on the external monitor. Tighten the finger screws.

Communication parameters are: baud rate 19200, no parity (none), data bits 8, stop bits 1. Mode of communication port: IFM out.

4.1.4 Connection to Nellcor N-100 and N-1000

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to one of the connectors on the Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor.

4.1.5 Connection to Nellcor N-200

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect one of the connectors to the corresponding connector on Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor. Connect also the mono connectors on the external monitor.

4.2   Interfacing external bedside devices via S/5 Device Interfacing Solutions, N-DISxxx

The Device Interfacing Solution, N-DISxxx provides means for transferring physiological, waveform and event data from various bedside patient care devices to the Datex-Ohmeda monitoring system. The real-time and trended data can be displayed on the monitor screen and used for record keeping purposes. The interfacing module reads the data coming from the external device, converts it to a suitable format and sends it to the monitor.

See the following table of DIS modules and devices that you can interface with the Device Interfacing Solution.

NOTE: The Device Interfacing Solution (DIS) is only compatible with the S/5 Compact Anesthesia and S/5 Compact Critical Care Monitor when the monitor has S/5 Monitor software of rev. 02 or later installed.

Table 3   DIS modules and interfaced devices

	Device Ventilators
N-DISEV4	Evita 4[a]
N-DISPRIM	Primus[a.] NOTE: Not available in the US
N-DIS7200	7200 Series Ventilator System[b]
N-DIS840	840 Ventilator System[b.]
N-DISS300	Servo Ventilator 300[c]
N-DIS7900	7900 SmartVent Ventilator[d]
N-DISAEST [e]	Aestiva/5[d.]
N-DISVENT	S/5 Aespire[d.] Aestiva/5[d.] Aisys Carestation[d.] S/5 Avance[d.] Centiva/5[d.] Engström Carestation[d.]

a.   Trademark of Dräger Medical AG & Co
b.   Trademark of Nellcor Puritan Bennet Inc
c.   Trademark of Maquet Critical Care AB part of the Getinge Group (previously trademark of Siemens)
d.   Trademark of GE Healthcare Finland Oy
e.   Replaced by N-DISVENT

	Device Monitors
N-DISOXIM3	Oximetrix 3[a]
N-DISQVUE	QVue /Q2[a.]
N-DISA2000	A-2000 Bispectral Index Monitoring System[b]
N-DISVIGIL	Baxter-Vigilance[c]
N-DISPICCO	PiCCO-Technology[d] NOTE: Not available in the US

N-DISRGM	RGM Monitor[e]
N-DISTONO	Tonocap[e.]
N-DISWHITE	Capnomac, Capnomac II[e.]
	Multicap, Normocap, CD2-O2[e.]
	Capnomac Ultima[e.]
	Normocap CD-200[e.]
	Oscar Oxy, Cardiocap 1GS, Cardiocap 2GS[e.]
	Satlite, Satlite Trans, Satlite Plus[e.]

a. Trademark of Hospira Inc. (previously trademark of Abbott Laboratories)
b. Trademark of Aspect Medical Systems
c. Trademark of Edwards Lifesciences Corporation
d. Trademark of Pulsion Medical Systems
e. Trademark of GE Healthcare Finland Oy

	Device Blood gas analyzers
N-DISOPT	AVL Opti CCA[a]
	Device Heart-lung machines
N-DISHL20	Jostra HL-20[b]

a. Trademark of Diamond Diagnostics Inc
b. Trademark of MAQUET GmbH & Co. KG part of the Getinge Group

For specific information on parameters transferred from the interfaced device to the Datex-Ohmeda monitor and the applicable software versions of the device refer to the Installation guide accompanying each DIS module.

4.2.1 Device Interfacing Solution components

The Device Interfacing Solution consists of:
- a device specific interfacing module
- a device specific cable
- a bus cable
- a connector for another bus cable
- label specifying the external device

4.2.2 Connections

Connect the device specific cable to the external device and the bus cable to the monitor's DIS connector or to another interfacing module.

(1) label specifying the external device

(2) LED indicators

(3) black bus cable from another interfacing module, if needed

(4) grey device specific cable to the communication port of the external device

(5) black bus cable to the monitor's DIS connector (or to another interfacing module)
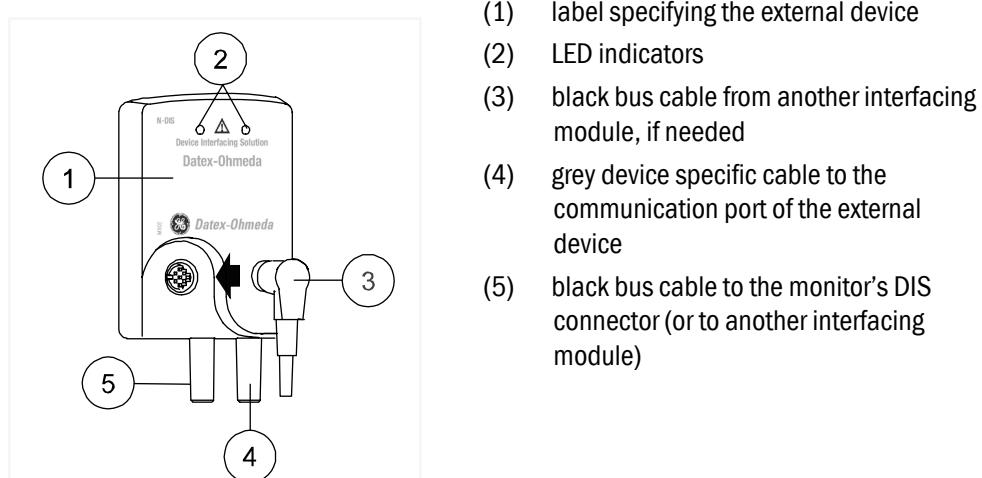
Figure 13   Connection cables and LED indicators

WARNING   The Compact Monitor, interfacing modules and interfaced devices must be situated in the same patient environment (as defined in IEC 60601-1-1).

WARNING   Connecting electrical equipment together or using the same extension cord for more than one device may cause their leakage currents to exceed the limits specified in relevant safety standards. Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.

WARNING   The manufacturer guarantees a reliable functioning of the devices with tested software versions only. Always refer to the Installation guide accompanying the DIS module and verify the compatibility before use.

4.2.3   Mounting

The DIS module can be mounted on the side panel of the external device. Also IV pole placement is possible.

NOTE: As the Device Interfacing Solution works only with the device specified in the label of the interfacing module, it is recommended that the interfacing module always travels along with the external device.

For mounting accessories, please refer to the "Supplies and Accessories" catalog. See the figure below for an example of a device interfacing.
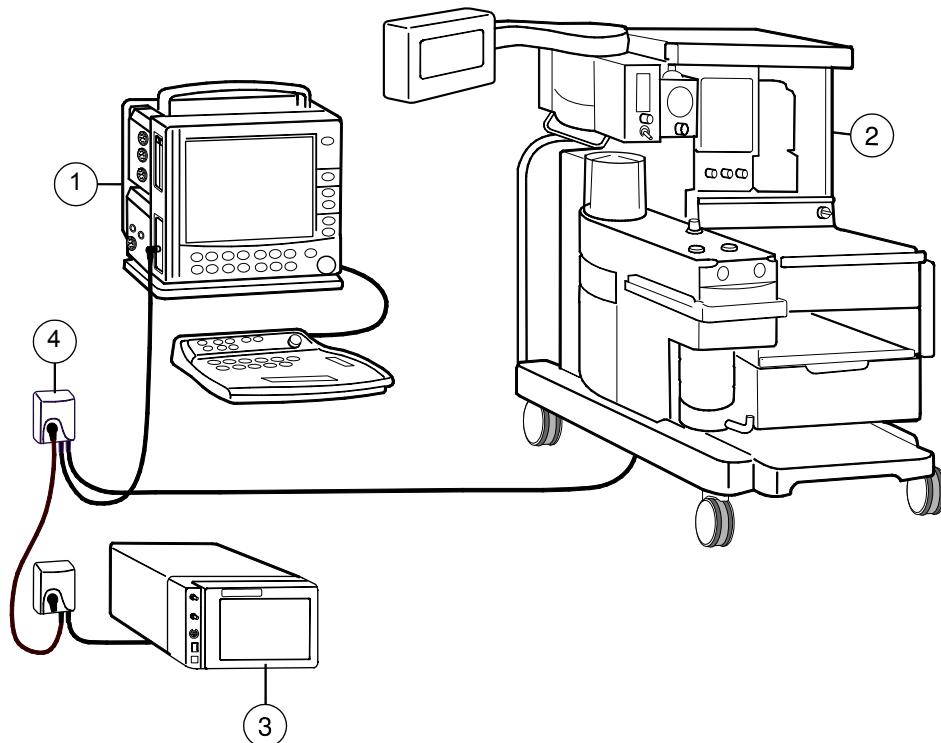
Figure 14   An example of interfacing external devices with Device Interfacing Solution

(1)   Datex-Ohmeda S/5 Compact Anesthesia Monitor (with software L-CANE02(A) or later)

(2)   Aestiva/5 anesthesia machine

(3)   RGM monitor

(4)   Interfacing module

NOTE: You can connect up to ten (10) interfacing modules to one system simultaneously. Check the maximum number of modules: one meter cable = max. four ten modules, three meter cable = max. three modules, six meter cable = one module.

CAUTION   Make sure that the interfacing module is always used in vertical position to prevent water from entering the module.

CAUTION   Make sure that you are connecting the interfacing module to the device specified in the label.

4.2.4   Selecting the external device

1.   Turn off the external device.

2.   Connect the interfacing module to the monitor's connector for S/5 DIS or to another interfacing module.

3.   Connect the device specific cable to the external device and turn the external device on.

4.   The monitor identifies the connected device automatically.

4.2.5   Functional check

There are two ways to check the function of the S/5 Device Interfacing Solution:

1.   Press the **Monitor Setup** key.

2.   Select *Interfacing* and open the *Status Page* menu. The status page shows you the current communication status of the interfacing module (1 - 10).

NOTE: The status message 'Connected' appears on the Status Page after you have connected the external device to the interfacing module and turned it on. Note also that the monitor and the interfacing module must be operational.

- Check the LED indicators on the interfacing module (the green LED indicates physical connections, the yellow LED software selections)

GREEN	YELLOW	INDICATION
lit ●	dark ○	Physical connections between the monitor, interfacing module and external device are in order and the device has been selected in the menu.
dark ○	lit ●	There is something wrong with the physical connections between the monitor, interfacing module and external device. The external device has not been selected in the menu.
lit ●	lit ●	Physical connections between the monitor, interfacing module and external device are in order but the external device has not been selected in the menu.
dark ○	dark ○	The interfacing module is not connected to the monitor.

4.2.6   Selecting the parameter data source

Select the external device via **Monitor Setup** - *Interfacing* menu:

- Select the desired parameter, for example *Gases.*
- Select the desired source by name, for example *Aestiva*.

NOTE: The name of the device is visible on the list only if the device is correctly connected.

NOTE: Detailed information about interfacing module related mountings, connections and settings is included in the installation guides that are delivered with the interfacing modules.

4.3 Interfacing Datex-Ohmeda Anesthesia Delivery Unit

It is possible to interface the Datex-Ohmeda Anesthesia Delivery Unit to the S/5 Compact Anesthesia Monitor via the serial interface port. The data link is bi-directional. The parameters transferred to the Anesthesia Delivery Unit are summarized in Table 4 and the events transferred to the S/5 Compact Anesthesia Monitor are summarized in Table 5. The events are transferred continuously once a minute or during the system check procedure and appear in the trend pages or in the anesthesia record. The transfer of events requires record-keeping software.

4.3.1 Interconnection

Use the ADU-AS/3 Monitor Cable.

4.3.2 Setting interfacing parameters on the S/5 Anesthesia Delivery Unit

1. Press the **Setup** key.
2. Select *Install* password 10.
3. Select *Interfacing* and choose S/5 AM.
4. Press the **Normal Screen** key.

4.3.3 Setting interfacing parameters on the S/5 Compact Anesthesia Monitor

No settings are required on the S/5 Compact Anesthesia Monitor.

Table 4   Parameters transferred from S/5 Compact Anesthesia Monitor to S/5 Anesthesia Delivery Unit

Waveforms	Numerics
CO_2	Et & Fi CO_2 %
	Et & Fi O_2 %
	O_2 % difference (I-E)
	Et & Fi N_2O%
	Et & Fi AA%
	Vol Exp MV
	Vol Exp TV

Table 5   **Events transferred from S/5 Anesthesia Delivery Unit to the S/5 Compact Anesthesia Monitor**

Events transferred once a minute	
Ventilator settings	Ventilation (mode) Tidal Volume Minute Volume Resp. Rate I:E Times: inp I:E Times: exp InspPause
Ventilator measurements	Ppeak Pplat Peep Pmin
Fresh gas settings	Agent name Agent % in fresh gas Total flow O_2 flow N_2O flow Air flow
Events transferred during system check	
System check test results	Gas Delivery: Agent Gas Delivery: N_2O Leak Tests: AUTO AUTO Leak (ml/min) Leak Test: MAN MAN Leak (ml/min) Number of confirmed checklist items Bypass Check

4.4   Interfacing Dräger Cicero, Cato, Julian and Narkomed 2C (by NAD)

It is possible to interface Dräger Cicero and Cato to the S/5 Compact Anesthesia Monitor or to the S/5 Compact Critical Care Monitor via the Interface Module, E-INT / M-INT.

The parameters transferred to the S/5 Compact Anesthesia Monitor or S/5 Compact Critical Care Monitor are summarized in Table 6 and Table 7.

NOTE: Some of the summarized parameters (waveforms or numerics) may not be available in all device versions.

WARNING   **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

4.4.1　Interconnection

Use the INT-External Device Cable, except for Julian and Cicero EM, in which case use the INT-Julian/Cicero EM cable.

1. Make sure that the power to both monitors is turned off.

2. Connect the 9 pin D-connector to one of the connectors on the Interface Module, E-INT / M-INT. Tighten the finger screws.

3. Connect the 25 pin D-connector to a corresponding connector on the anesthesia machine. The connector is labeled 'RS-232-C'. Tighten the finger screws.

4.4.2　Setting communication parameters

Set the communication parameters for Cicero and Cato to RS-232: 9600, e, 8, 1 (MEDIBUS 3.00). In all cases please refer to the documentation provided by Dräger.

4.4.3　Setting interfacing parameters on the S/5 Compact Anesthesia or Compact Critical Care Monitor

1. Press the **Monitor Setup** key.

2. Select *Install/Service* (password 16-4-34).

3. Select *Service* (password 26-23-8) - *Parameters - More...*

4. Select *Interface* and combine a required parameter with the external monitor. Two letters, al, denote alarm integration. The selection will be automatically stored in permanent memory.

5. Press the **Normal Screen** key.

Table 6　　Parameters transferred from Dräger Cicero monitor to S/5 Compact Anesthesia Monitor or S/5 Compact Critical Care Monitor

Selection	Waveforms	Numerics	States
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et (%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1) Ppeak (mbar) Pplat (mbar), PEEP (mbar)	None
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

Table 7 **Parameters transferred from Dräger Cato, Julian and Narkomed 2C (NAD) monitor to the S/5 Compact Anesthesia Monitor or S/5 Compact Critical Care Monitor**

Selection	Waveforms	Numerics	States
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et(%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1) Ppeak (mbar) Pplat (mbar); not in Narkomed 2C PEEP (mbar)	None
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

NOTE: The transference of parameters illustrated in Table 4 and Table 5 represents the maximum. Some of these parameters may not be available in all device versions.

NOTE: The transference of waveforms requires the MEDIBUS real-time extension and, in Cato monitors, waveforms are available only on port 1.

4.5 Interfacing printer

It is possible to interface a laser printer (serial or parallel) with the S/5 Compact Monitors via the monitors' serial port. The printer should be PCL5 compatible and should contain at least 2 MB of memory. Parallel printers require the use of Serial-to-Parallel Converter, order code 78030, model PI 130-R2 or PI 1115A.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **Connecting the power supply cord of the printer to the wall power outlet may cause the printer leakage current to exceed the limit specified for medical equipment. A printer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).**

4.5.1 Setting S/5 Compact Monitor interface for printers

1. Press the **Print/Record** key.
2. Select *Printer Connection*.
3. Select *Serial.*
4. Press the **Normal Screen** key.

4.5.2 Connection to serial printers

A serial printer is connected to the serial port connector X11 on the frame unit.

Contact your authorized GE Healthcare distributor for advice on suitable serial printers.

4.5.3 Connection to parallel printers

A parallel printer is connected to the serial interface port connector X11 on the frame unit via the Serial-to-Parallel Converter, order code 78030, model PI130-R2 or PI1115A.

Contact your authorized GE Healthcare distributor for advice on suitable parallel printers.

4.5.4 Installing the Serial-to-Parallel Converter

Order code 78030, model PI130-R2

A common serial modem cable, gender changer and parallel printer cable are required when connecting the serial to parallel converter between the monitor and a parallel printer. The converter gets power from the connected devices.

1. Make sure that power is switched off on both devices.

2. Connect a standard PC-to-parallel-printer cable (order code 713701) to the parallel printer.

3. Check the DIP-switch settings on the converter (order code 78030, model PI130-R2):

	Position							
	1	2	3	4	5	6	7	8
Flow Control: hardware	OFF							
LED: Enabled		ON						
Parity/D, Bits/S, Bit: None/8/1			OFF	OFF	OFF			
D.Rate (kbps): 115,2						OFF	ON	OFF

4. Connect a DB25 female-to-female gender changer (order code 78032) between the printer cable and converter.
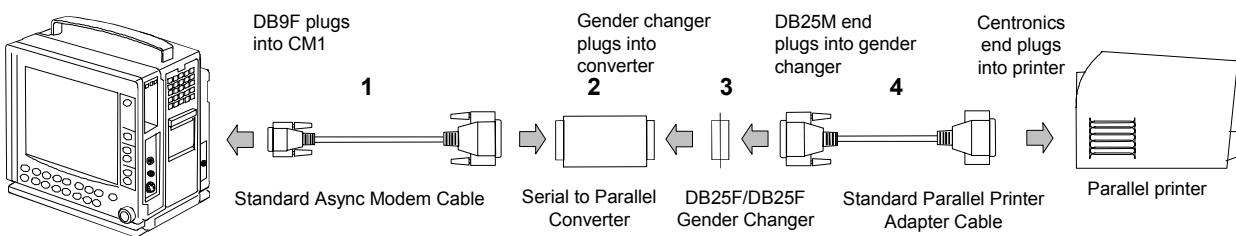
Figure 15   Connecting S/5 Compact Monitor to printer, converter model PI130-R2

5. Connect a common RS-232 modem cable's (order code 78031) DB9 connector to the serial port connector X4 on the monitor, and the DB25 connector to the converter.

Order code 78030, model PI1115A

A common serial modem cable, power adapter and parallel printer cable are required when connecting the serial to parallel converter between the monitor and a parallel printer. The converter gets power from an external power supply and requires an external power adapter.

NOTE: The order code 78030 includes the new serial to parallel converter PI1115A and the European power adapter PS1002-EU (230 VAC/50 Hz). Power adapters for US, UK or Asian markets must be locally sourced from Black Box Corporation through its international distributor network, see http://www.blackbox.com - Contact us - Contacts by Country.

To connect the S/5 Compact Monitor to printer:

1. Make sure that power is switched off on both devices.
2. Connect a standard PC-to-parallel-printer cable (order code 713701) to the parallel printer.
3. Check the DIP-switch settings on the converter (order code 78030, model PI1115A).

Setting	Position							
	1	2	3	4	5	6	7	8
115.2K Baud	ON	ON	ON					
XON/XOFF				OFF				
8 Data bits					OFF			
No parity						OFF		
Even parity							OFF	
Serial to Par.								OFF

4. Connect a common RS-232 modem cable's (order code 78031) DB9 connector to the serial port connector X4 on the monitor, and the DB25 connector to the converter.

5. Connect the converter to external power supply using the power adapter PS1002-xx.
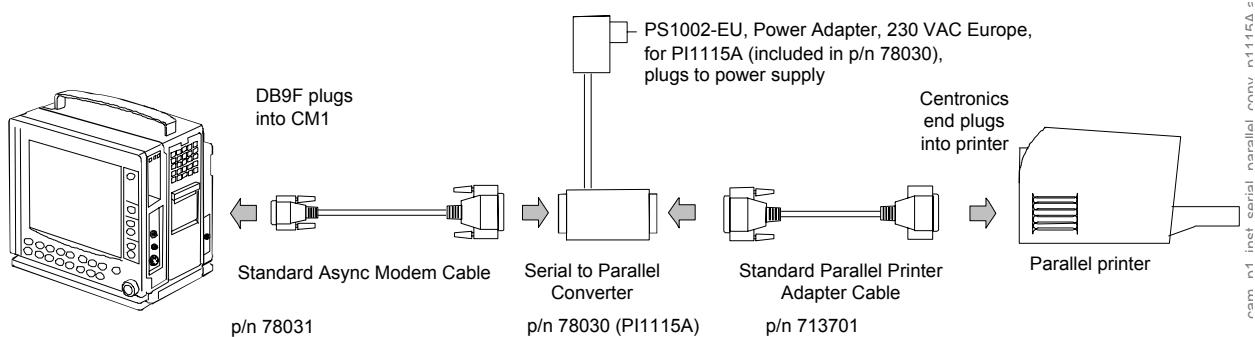
Figure 16   Connecting S/5 Compact Monitor to printer, converter model PI 1115A

4.5.5   Connection to printer

Setting the printing parameters

Refer to the documentation provided with the printer.

4.6   Interfacing computer

A computer is connected to the serial port connector X11 on the frame unit. Contact your authorized GE Healthcare distributor for further advice on computer interface.

WARNING   **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING   **Connecting the power supply cord of the computer to the wall power outlet may cause the computer leakage current to exceed the limit specified for medical equipment. A computer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).**

4.7   Output signals

Analog/ digital output signals on the connectors X4 and X8 can be used for interfacing with other devices. The pin assignments are illustrated in tables/pictures below.

Table 8   Coding element connector, X4

9 pin female D-connector	Pin	Signal
	1	IDCS1 (chip select)
	2	IDCL (clock)
	3	IDDI (data in)
	4	IDDO (data out)
	5	IDPE (protect enable)
	6	+5Vdc
	7	Direct ECG
	8	Nurse call
	9	GND

Table 9   Synchronization connector, X8

4 pin female connector	Pin	Signal
	1	GND
	2	Def_Sync
	3	Direct ECG
	4	Pressure Out
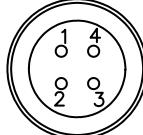
4.7.1   Digital outputs

The digital output signals are as follows:

Defibrillation Sync (X8 pin 2)

The defibrillation sync signal is generated by the ECG. When activated, the signal is set to a high level and then set back to a low level after 10 ms. The signal is regenerated only after returning to the low level. The high level ranges from 2.8 to 5 V, while the low level ranges from 0 to 0.8 V. The delay from the R wave peak to the start of the signal is 35 ms maximum.

Nurse Call(X4 pin 8)

The Nurse Call signal is generated by red and yellow alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high state range is from 2.8 to 5 V, while the low state range is from 0 to 0.8 V.

4.7.2 Analog outputs

Direct ECG (X4 pin 7 and X8 pin 3)

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

The signal requires input impedance of 100 kΩ.

NOTE: The ECG signal is based on the ECG measurement of the Hemodynamic Modules, M-ESTPR (all variations), M-NES(12)TPR (all variations), E-PRESTN/ M-PRESTN (all variations). The ECG signal from the modules is channel 1 (ECG1). The channels 2 and 3 (ECG2, ECG3) are not transmitted. Make sure that the signal in channel 1 (ECG1) is good enough (extensive QRS for IABP synchronization). For further information, please contact your authorized GE Healthcare distributor.

Pressure out (X8 pin 4)

− P1 from Hemodynamic Module

NOTE: With monitor software version 03 or earlier, the Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 300 mmHgand with a delay of approximately 25ms. The signal requires an input impedance of 100k.

4.7.3 S/5 Pressure Temp Module, E-PT or M-PT, output signals

The signal output connector on the Pressure Temp Module, E-PT or M-PT, can be used to interface some models of IABPs to the S/5 Compact Anesthesia Monitor and S/5 Compact Critical Care Monitor. The pin assignments are illustrated in Table 10. Please contact your local distributor for more information.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Table 10   Signal output connector pin assignments
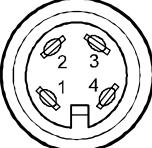
	Pin	Signal
	1	ECG out, ECG1
	2	Pressure out, P3
	3	ECG out, ECG1
	4	Ground

Output signals

ECG out, ECG1	1V / 1mV
Pressure out, P3	1V / 100mmHg
ECG out, ECG1	1V / 1mV

5 Functional check

These instructions include procedures for a functional check for Datex-Ohmeda S/5 Compact Anesthesia Monitor and S/5 Compact Critical Care Monitor. The functional check is recommended to be performed after monitor installation.

These instructions include a "Functional check form, Datex-Ohmeda S/5 CAM, CCCM" to be filled in when performing the procedures. The symbol ✍ in the instructions means that the performed procedure should be signed in the check form. The procedures should be performed in ascending order, bypassing those that are not applicable for a particular monitor.

All menu selections related to Datex-Ohmeda products are written in following typeface:

e.g. *Parameters - Gas Unit.*

As you enter the service menus, you need the following passwords:

Monitor Setup - *Install/Service* (password 16-4-34) - *Service* (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add simulator's accuracy specification to the one of the monitor.

An electrical safety check and a leakage current test are recommended to be performed prior to the monitor installation.

5.1 Recommended tools

For product(s)	Tool	Order No.
Airway modules		
Compact Airway Module, E-CAiO(VX)/ M-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module, E-COVX/ M-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V), M-C, M-CO(V)	Calibration gas and regulator	755581/755534*
E-miniC/ M-miniC	Calibration gas and regulator	755580/755534*
Compact Airway Module, E-COVX, E-CAiOVX, M-COVX, M-CAiOVX	Sampling line, 2 m	73318
All Airway modules w/ (V)	Spirometry tube, 2 m	890031
	D-lite	733950
Hemodynamic modules		
Hemodynamic modules w/ (P), M-NIBP	NIBP cuff and hose	2753E (cuff) 877235 (hose)
Hemodynamic modules w/ (P)	InvBP transducer	70077-001

For product(s)	Tool	Order No.
E-PSM(P)/ E-PRESTN/ M-PRESTN	**Multi-Link ECG accessories, IEC**	
	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	4162681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
M-NESTPR	3-lead ECG trunk cable	545302
	5-lead ECG cable	545303
M-NESTPR w/ (E12)	10-leadwire ECG cable	545324
E-PSM(P)/ E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
M-PRESTN	SpO_2 finger probe	OXY-F4-N or SAS-F4
E-NSAT/ M-NSAT	Nellcor SpO_2 probe	
Hemodynamic modules w/ (T)	Temperature test set	884515
Hemodynamic E-Modules w/ (NIBP)	Adult NIBP cuff hose with cuff ID	2021285-001
	Infant cuff hose without cuff ID	414874-001
Hemodynamic M-Modules w/ (NIBP)	Adult NIBP cuff	572435
	Adult NIBP cuff hose	877235
E-COP/ E-COPSv/ M-COP/ M-COPSv	C.O. Catheter cable	16590
E-COPSv/ M-COPSv	SvO_2 simulator	890121
Tonometry Module, E-TONO/ M-TONO	Calibration gas and regulator	755580/755534*
	Sampling line	733251
	Tonometrics™ catheter	TONO-14F or another suitable TONO-_F catheter
	Luer plug	
	Pressure manometer	
EEG Module, E-EEG/ M-EEG	Earphones	
	EEG simulator	90502

For product(s)	Tool	Order No.
BIS Module, E-BIS/ M-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY/ M-ENTROPY	Entropy simulator	N-ES
	Entropy sensor cable	8002964
E-NMT/ M-NMT	NMT simulator	871251
	M-NMT ElectroSensor	888416
	M-NMT sensor cable	888415
MemCard option	MemCard – Data or Menu	893860 (Menu, English) 887045 (Data, English)

NOTE: * Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required. For more information see section "Adjustments and calibrations" in Compact Airway modules slot.

For details on recommended accessories see "Supplies and Accessories" catalog.

5.1.1   Hemodynamic patient simulators

The following tables present the patient simulators' compatibility with each hemodynamic module, and the accessories needed:

Table 11   Patient simulators' compatibility with each hemodynamic module

Module	Parameter	Patient simulator		
		M1010831	MedSim	874027
E-PSM(P), E-PRESTN 	ECG	Ok	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Ok	M1010858	
M-PRESTN 	ECG	Ok	Multilink ECG acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok
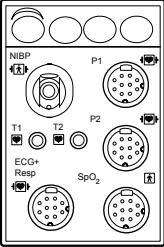
Module	Parameter	Patient simulator		
		M1010831	MedSim	874027
M-NESTPR	ECG	Not compatible	300 series acc.	Ok
	12 lead ECG	Not compatible	300 series acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok

Table 12   Adapter cables for hemodynamic patient simulators

Patient simulator	Adapter cables for simulators	
Hemodynamic patient simulator	- Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	- Dual Inv.BP adapter cable	2005772-001
Medsim	- Temperature adapter cable	M1010832
Medsim	- Inv.BP adapter cable	M1010858
Lionheart & MPS450	- Temperature adapter cable	M1010846
Lionheart & MPS450	- Inv.BP adapter cable	M1010862

5.2   Visual inspection

- Make sure that the monitor is switched to standby.
  Disconnect the mains power cord from the monitor.
  If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from the monitor. Remove any memory cards, if installed.

1. Check all units visually

   Check that all parts are intact and that the cables and screws are connected and tightened properly. Especially check the following parts:

   — the display unit locking screw is in a locking position.

   — sampling line is connected to the Airway Module, if installed.

   Check that modules go in smoothly and lock up properly.

5.3   Functional inspection

5.3.1   General

1. Connect the mains power cord.
    Check that the LED above the main switch is lit continuously (full charged batteries) or periodically (charging batteries).

2. Switch the monitor on.
    Check that the monitor starts up properly, i.e. a normal start-up sound is heard from the loudspeaker, the alarm LEDs turn on and off, and the monitoring screen appears.
    No error messages should appear on the screen.

3. Configure the screen for the parameters that are connected.

4. Enter the ***Service Menu***.

    When applicable, check from the corresponding ***Parameters*** submenu that the Timeouts, Bad checksums and Bad c-s by mod values of inserted modules are not increasing faster than by 5 per second. Check also that the module memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
    If installed, the recorder should record two lines of start-up information.

    ✍

    Preset the measurement settings for those parameters that are connected, for example:

    Recorder *- Record Waveforms - Waveform 1 - ECG1*
    - Waveform 2 - P1
    - Waveform 3 - P2

    Invasive Pressures *- P1 'ART' Setup -- Label – ART*
    - P2 'CVP' Setup -- Label – CVP
    - P3 Setup -Label –PA
    - P4 Setup -Label -P4
    - P5 Setup -Label -P5
    - P6 Setup -Label -P6

    Pulse Oximetry *-Pleth Scale –AUTO*

    or

    Others *-SPO2 Setup - Pleth Scale –AUTO*

    Airway Gas *-Spirometry View -Scaling -Indep.*
    -Paw Scale –20
    -Flow Scale –15
    or

    Ventil. *-Spirometry Setup -Scaling -Indep.*
    -Paw Scale –20
    -Flow Scale –15

    Others *-Resp Setup -Size -1.0*

    - Resp Rate Source – AUTO
    - Measurement – ON
    - Detection Limit – AUTO

5.3.2 Display

1. Check that the picture on the screen is correct.

    ✍

5.3.3 Keyboard(s)

1. Tests with all the connected keyboards:

    – Press the **Monitor Setup** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select *Normal Screen* and check that the menu disappears from the screen.

    Tests with the Command Board:

    – Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select *Normal Screen* and check that the menu disappears from the screen.
    Check the rest of the menu keys by pressing them one by one.

    Tests with the ARK Keyboard:

    – Enter the *Keyboard* service menu

    – Check functioning of the ComWheel.

    – Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

    – Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

    Tests with the Remote Controller:

    – Enter the *Keyboard* service menu.

    – Check the function of the ComWheel.

    – Press all keys. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

    ✍

5.3.4 Frame unit

1. Check that the frame fan is running.

    ✍

5.3.5 Display unit

2. Check that the clock on the screen shows correct time. Readjust the time and date, if necessary.

    ✍

5.3.6 Compact Airway Module, E-CXXXXX/ M-CXXXXX

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Check that the fan is running.
2. If the module contains membrane keys on the front panel, press each of the keys for at least one second and check that they are identified.

✍

Compact Airway Modules with the Patient Spirometry option

3. Connect a clean spirometry tube and D-lite to the module. Connect the sampling line. Breathe through the wider side of the D-lite.
Check that the flow waveform moves downwards when you breathe in and upwards when you breathe out.

✍

For all Compact Airway Modules

4. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
5. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.
6. Breathe to the sampling line briefly. Check that the CO_2 information is updated on the screen.

✍

5.3.7 Single width Airway Module, E-miniC/ M-miniC

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
2. Detach the Mini D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.

Breathe to the sampling line briefly. Check that the CO_2 information is updated on the screen.

✍

5.3.8 Tonometry Module, E-TONO/ M-TONO

1. Press each of the front panel membrane keys for at least one second and check that they are identified.

✍

5.3.9   Multiparameter Hemodynamic Modules

ECG and RESP measurements

1. Check the function of the front panel membrane key **ECG**, **Lead**, if available.
2. Connect an ECG cable to the module. Connect the cable leads to a patient simulator. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Turn the simulator off. Check that the 'Asystole' and 'Apnea' messages are displayed.

Temperature measurement

3. Check the temperature channels with a patient simulator.

   Check that temperature measurement information is shown on the monitor screen as configured on the simulator.

Invasive blood pressure measurement

4. Check the function of the front panel membrane keys.
5. Check the InvBP channels with a patient simulator.
6. Zero the InvBP channels and check that the values and waveforms correspond to the simulator settings.

SpO2 measurement

7. Connect an SpO2 finger probe to the module. Check that the message 'Probe off' is shown when the probe is not connected to a finger.
8. Attach the SpO2 probe to your finger. Check that a reading of 95-99 and a pleth waveform appear on the screen

Non invasive blood pressure measurement

9. Check the function of the front panel membrane keys.
10. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

    Check that the module gives a reasonable measured result.

5.3.10   Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT

Invasive blood pressure measurement

1. Check the function of the front panel **Zero P3** key.

2.   Check the InvBP channel with a patient simulator.

Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

☞

Temperature measurement

3.   Check the temperature channels with a patient simulator.

Check that the temperature measurement information is shown on the monitor screen as configured on the simulator.

☞

5.3.11 Dual pressure Module, E-PP/ M-PP

1.   Check the function of the front panel **Zero P5** and **Zero P6** keys.
2.   Check the InvBP channels with a patient simulator.

Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

☞

5.3.12 Cardiac Output Modules, E-COP/ M-COP, E-COPSv/ M-COPSv

Invasive blood pressure measurement

1.   Check the function of the front panel **Zero P4** key.
2.   Check the InvBP channel with a patient simulator.

Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

☞

Cardiac Output measurement

3.   Check the function of the front panel **Start C.O.** key.

☞

5.3.13 NIBP module, M-NIBP

1.   Check the function of the front panel membrane keys.
2.   Attach an adult NIBP cuff onto your arm and perform one NIBP measurement.

Check that the module identifies the cuff, i.e. the text 'Adult ' appears on the NIBP digit field for a short time.

Check that the module gives a reasonable measured result.

☞

5.3.14 Nellcor Compatible Saturation module, E-NSAT/ M-NSAT

1. Connect a Nellcor SpO2 finger probe to the module. Check that the message 'Pulse search ' is shown. Check also that the shown message changes to 'Check probe ' within 30 seconds.

2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

5.3.15 Datex-Ohmeda Oxygen Saturation module, M-OSAT

1. Connect an OxyTip ® + Reusable Finger Sensor such as Integrated Finger Sensor OXY-F4-N to the module. Check that the message 'No Probe' in the screen changes to 'Check probe'.

2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

5.3.16 BIS Module, E-BIS/ M-BIS

1. Connect the BIS module to the monitor frame.
   Check that 'Cable off' is displayed in the BIS waveform field.

2. Connect the DSC to the module.
   Check that the 'No sensor' message appears in the waveform field.

3. Check the function of the front panel membrane keys.
   Open the ***BIS Setup*** menu: **BIS** - ***BIS Setup*** and check that ***Test DSC*** shows PASS.

   NOTE: If the sensor is not connected, the **Check Sensor** key is inoperative.

5.3.17 Entropy Module, E-ENTROPY/ M-ENTROPY

1. Check the function of the front panel membrane keys.

2. Connect the Entropy sensor cable and Entropy simulator to the module. Check that 'Checking sensor' text and an image appear in the waveform numeric field. Wait for a while and check that all sensors show PASS.

3. Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

5.3.18 Data Card and Menu Card function

1. Insert a Data card or a Menu card to the slot.
   Check that the corresponding symbol appears on the monitor screen.

5.3.19 Recorder

1. Press the **Record Wave** module key and check that the module starts recording the selected waveforms. Press the **Stop** module key to stop recording.

2. Check that the quality of the recordings is acceptable.

5.3.20 Network connection

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the frame unit.

   Check that the monitor connects to the network, i.e. the network symbol appears on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

5.3.21 Wireless Network Option

1. Check that the green LED on the wireless antenna card blinks and the WLAN signal strenght symbol scrolls between zero and full or stays fixed on the monitor screen.

2. Check that the wireless LAN network symbol appears on the upper right-hand corner of the screen when the monitor connects to the Datex-Ohmeda Network.

   NOTE: If the monitor does not connect to the Datex-Ohmeda Network, check the WLAN configuration on the monitor and on the network.

5.3.22 Interface Module, E-INT/ M-INT

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup – *Interfacing*

5.3.23 Device Interfacing Solution, N-DISxxx

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup - *Interfacing* - *Status Page*

5.3.24 General

- Switch the monitor to standby
- Perform final cleaning
- Fill in all necessary documents

6   General troubleshooting
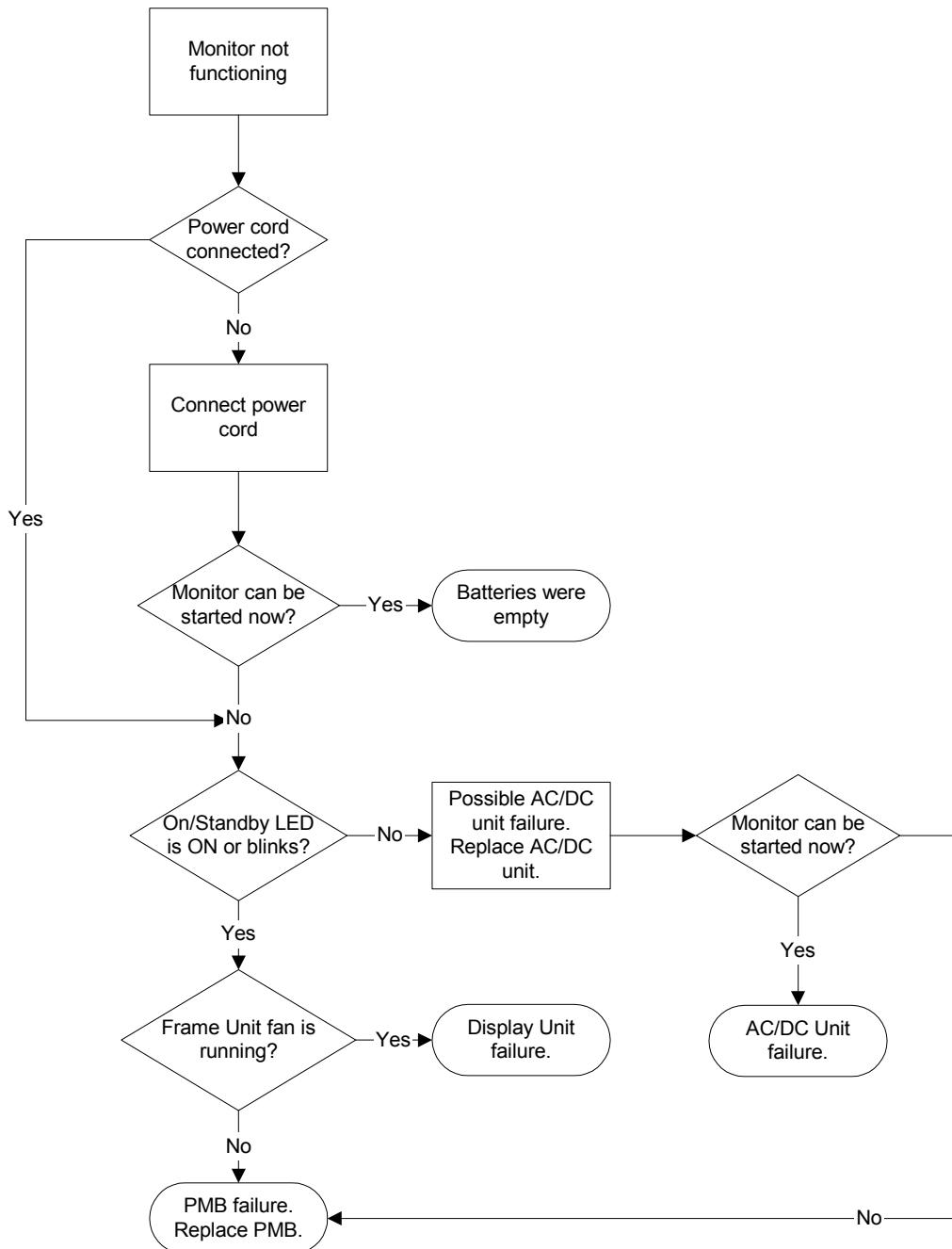
Figure 17   S/5 Compact Monitor general troubleshooting flowchart

APPENDIX A   Functional check form, Datex-Ohmeda S/5 CAM, CCCM

Customer	
Service	
Service engineer	Date

Monitor Installation			
Frame: F-CM_____	System options:	E/M-	
Software:	N-	E/M-	
K-	N-	E/M-	
K-	N-	E/M-	

OK = Test OK   **N.A. = Test not applicable**   **Fail = Test failed**

Visual Inspection			OK	N.A.	Fail
1. Check all units visually			☐	☐	☐

Functional Inspection			OK	N.A.	Fail
5.3.1. General			☐	☐	☐
5.3.2. Display			☐	☐	☐
5.3.3. Keyboard(s)	S/N		☐	☐	☐
5. Functional check	S/N		☐	☐	☐
5.3.5. Display unit			☐	☐	☐
Notes					
5.3.6. Compact Airway Module, E-CXXXXX/ M-CXXXXX	S/N		☐	☐	☐
. Compact Airway Modules with the Patient Spirometry option			☐	☐	☐
. For all Compact Airway Modules			☐	☐	☐
5.3.7. Single width Airway Module, E-miniC/ M-miniC	S/N		☐	☐	☐

Functional Inspection		OK	N.A.	Fail
Notes				
5.3.8. Tonometry Module, E-TONO/ M-TONO	S/N	☐	☐	☐
5.3.9. Multiparameter Hemodynamic Modules	S/N	☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SpO2 measurement		☐	☐	☐
. Non invasive blood pressure measurement		☐	☐	☐
Notes				
5.3.10. Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Temperature measurement		☐	☐	☐
5.3.11. Dual pressure Module, E-PP/ M-PP	S/N	☐	☐	☐
Notes				
5.3.12. Cardiac Output Modules, E-COP/ M-COP, E-COPSv/ M-COPSv	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Cardiac Output measurement		☐	☐	☐
Notes				
5.3.13. NIBP module, M-NIBP	S/N	☐	☐	☐
5.3.14. Nellcor Compatible Saturation module, E-NSAT/ M-NSAT	S/N	☐	☐	☐

Functional Inspection		OK	N.A.	Fail
5.3.15. Datex-Ohmeda Oxygen Saturation module, M-OSAT	S/N	☐	☐	☐
5.3.16. BIS Module, E-BIS/ M-BIS	S/N	☐	☐	☐
5.3.17. Entropy Module, E-ENTROPY/ M-ENTROPY	S/N	☐	☐	☐
5.3.18. Data Card and Menu Card function	S/N	☐	☐	☐
5.3.19. Recorder	S/N	☐	☐	☐
5.3.20. Network connection	S/N	☐	☐	☐
5.3.21. Wireless Network Option	S/N	☐	☐	☐
5.3.22. Interface Module, E-INT/ M-INT	S/N	☐	☐	☐
5.3.23. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
Notes				
5.3.24. General		☐	☐	☐
• Perform final cleaning		☐	☐	☐
• Fill in all necessary documents		☐	☐	☐
Notes				

Signature

For your notes:

APPENDIX B   ElectroMagnetic Compatibility

Table 1   Guidance and manufacturer's declaration – electromagnetic emissions

Guidance and manufacturer's declaration – electromagnetic emissions		
The S/5™ CAM/ CCCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ CAM/ CCCM should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The S/5™ CAM/ CCCM uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Group 2 [1]	The S/5™ CAM/ CCCM must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected.
RF emissions CISPR 11	Class B	The S/5™ CAM/ CCCM is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

[1]   S/5™ CAM/ CCCM equipped with N-CMW option

Table 2   Guidance and manufacturer's declaration – electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
The S/5™ CAM/ CCCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ CAM/ CCCM should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transients/bursts IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If user of the S/5™ CAM/ CCCM requires continued operation during power mains interruptions, it is recommended that the S/5™ CAM/ CCCM be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic field should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage prior to application of the test level.			

Table 3   Guidance and manufacturer's declaration – electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
The S/5™ CAM/ CCCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ CAM/ CCCM should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the S/5™ CAM/ CCCM, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
	3 Vrms 150 kHz to 80 MHz	1 Vrms [1)	$d = 3.5\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz
			$d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz
	3 V/m 80 MHz to 2.5 GHz	1 V/m [2)	$d = 3.5\sqrt{P}$ 80 MHz to 800 MHz
			$d = 7\sqrt{P}$ 800 MHz to 2.5 GHz
			where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE 1	At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2	These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.
a	Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the S/5™ CAM/ CCCM is used exceeds the applicable RF compliance level above, the S/5™ CAM/ CCCM should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the S/5™ CAM/ CCCM.
b	Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

(1 For impedance RESP measurement. For invasive pressure measurement in M-series modules except M-PRE(S)TN. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

(2 For BIS measurement in E-BIS/M-BIS, RESP measurement in M-(P)RE(S)TN and invasive pressure measurement in M-COPSv/E-COPSv and M-COP/E-COP modules. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

Table 4   Recommended separation distances between portable and mobile RF communications equipment and the S/5™ CAM/ CCCM

Recommended separation distances between portable and mobile RF communications equipment and the S/5™ CAM/ CCCM.			
The S/5™ CAM/ CCCM is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the S/5™ CAM/ CCCM can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the S/5™ CAM/ CCCM as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter** m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ [1]	80 MHz to 800 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ [2]	80 MHz to 800 MHz $d = 2.3\sqrt{P}$ $d = 7\sqrt{P}$ [2]
0.01	0.12 0.35 [1]	0.12 0.35 [2]	0.23 0.70 [2]
0.1	0.38 1.1 [1]	0.38 1.1 [2]	0.73 2.2 [2]
1	1.2 3.5 [1]	1.2 3.5 [2]	2.3 7.0 [2]
10	3.8 11 [1]	3.8 11 [2]	7.3 22 [2]
100	12 35 [1]	12 35 [2]	23 70 [2]
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

[1]   For impedance RESP measurement. For invasive pressure measurement in M-series modules except M-PRE(S)TN. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

[2]   For BIS measurement in E-BIS/M-BIS, RESP measurement in M-(P)RE(S)TN and invasive pressure measurement in M-COPSv/E-COPSv and M-COP/E-COP modules. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

For your notes:

Datex-Ohmeda

S/5™ Compact Anesthesia Monitor
S/5™ Compact Critical Care Monitor

Planned Maintenance Instructions

Table of contents

1 Planned maintenance instructions

1.1 Introduction

These instructions include procedures for planned maintenance (PM) for the Datex-Ohmeda S/5 Compact Anesthesia Monitor and S/5 Compact Critical Care Monitor. The Planned maintenance should be performed once a year.

These instructions include "Planned maintenance check form, S/5 Compact Monitors" to be filled in when performing the corresponding procedures.

The symbol ✍ in the instructions means that the procedure performed should be signed in the check form.

The procedures should be performed in ascending order, bypassing those that are not applicable for a particular monitor.

If you need further information on how to perform a certain Planned maintenance procedure, please refer to the corresponding slot in the Technical Reference Manual.

All menu selections related to the Datex-Ohmeda monitors are written in the following typeface:

e.g. *Parameters - Gas Unit*

As you enter the service menus, you need following passwords:

Monitor Setup - *Install/Service* (password 16-4-34) **-** *Service* (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add the simulator's accuracy specification to the one for the monitor.

1.2 Recommended tools

For product(s)	Tool	Order No.
All Airway modules	Flowmeter	
Compact Airway Module, E-CAiO(VX)/ M-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module, E-COVX/ M-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V), M-C, M-CO(V)	Calibration gas and regulator	755581/755534*
E-miniC/ M-miniC	Calibration gas and regulator	755580/755534*
Compact Airway Module, E-COVX, E-CAiOVX, M-COVX, M-CAiOVX	Sampling line, 2 m	73318
All Airway modules w/ (V)	Spirometry tube, 2 m	890031
All Airway modules w/ (V)	D-lite	733950
All Airway modules	Sampling line, 6 m/19.7 ft	73306
Hemodynamic modules		
Hemodynamic modules w/ (P), M-NIBP	NIBP cuff and hose	2753E (cuff) 877235 (hose)

For product(s)	Tool	Order No.
Hemodynamic modules w/ (P)	InvBP transducer	70077-001
	Multi-Link ECG accessories, IEC	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	4162681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
M-NESTPR	3-lead ECG trunk cable	545302
M-NESTPR	5-lead ECG cable	545303
M-NE12STPR	10-leadwire ECG cable	545324
E-PSM(P)/ E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
M-PRESTN	SpO_2 finger probe	OXY-F4-N or SAS-F4
E-NSAT/ M-NSAT	Nellcor SpO_2 probe	
Hemodynamic modules w/ (T)	Temperature test set	884515
Hemodynamic E-Modules w/ (NIBP)	Adult NIBP cuff hose with cuff ID	2021285-001
	Infant cuff hose without cuff ID	414874-001
Hemodynamic M-Modules w/ (NIBP)	Adult NIBP cuff	572435
	Adult NIBP cuff hose	877235
E-COP, E-COPSv, M-COP, M-COPSv	C.O. Catheter cable	16590
E-COPSv/ M-COPSv	SvO_2 simulator	890121
Tonometry Module, E-TONO/ M-TONO	Calibration gas and regulator	755580/755534
	Sampling line	733251
	Luer plug	
	Pressure manometer	
	Tonometrics™ catheter	TONO-14F or another suitable TONO-_F catheter
EEG Module, E-EEG/ M-EEG	Earphones	
	EEG simulator	90502

For product(s)	Tool	Order No.
BIS Module, E-BIS/ M-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY/ M-ENTROPY	Simulator for M-ENTROPY	N-ES
	Entropy sensor cable	8002964
E-NMT/ M-NMT	NMT simulator	871251
	NMT ElectroSensor	888416
	NMT sensor cable	888415
	MemCard – Menu	893860 (English)
	MemCard – Data	887045 (English)
All M-Modules	Screwdrivers	
All E-Modules	Torx screwdrivers; T8, T10	

NOTE: * Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required. For more information see section "Adjustments and calibrations" in Compact Airway modules slot.

1.2.1 Hemodynamic patient simulators

The following tables present the patient simulators' compatibility with each hemodynamic module, and the accessories needed:

Table 1 Patient simulators' compatibility with each hemodynamic module
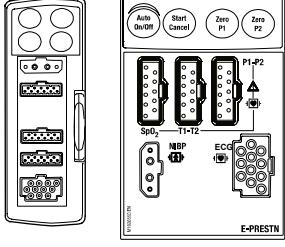
Module	Parameter	Patient simulator		
		M1010831	MedSim	874027
E-PSM(P),E-PRESTN	ECG	Ok	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Ok	M1010858	

Module	Parameter	Patient simulator		
		M1010831	MedSim	874027
M-PRESTN 	ECG	Ok	Multilink ECG acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok
M-NESTPR 	ECG	Not compatible	300 series acc.	Ok
	12 lead ECG	Not compatible	300 series acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok
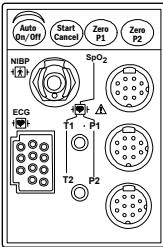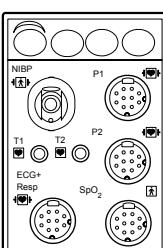
Table 2   Adapter cables for hemodynamic patient simulators

Patient simulator	Adapter cables for simulators	
Hemodynamic patient simulator	Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	Dual Inv.BP adapter cable	2005772-001
Medsim	Temperature adapter cable	M1010832
Medsim	Inv.BP adapter cable	M1010858
Lionheart & MPS450	Temperature adapter cable	M1010846
Lionheart & MPS450	Inv.BP adapter cable	M1010862

1.3   Recommended parts

For product(s)	Part	Order No.
CM(C) Frame Unit	Fan filter	896085
CM(C) Display Unit	Fan filter	874594
Central Processing Board	Battery for SRAM/Timekeeper	197230
	Recorder paper	74205
Tonometry Module, E-TONO/ M-TONO		733382

1.4   Planned maintenance parts

1.4.1   PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX without CO2 absorber - Anesthesia

Part	Order No.	For product(s)
Special tube (Nafion)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001758.

1.4.2   PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX without CO2 absorber - Critical Care

Part	Order No.	For product(s)
Special tube (Nafion)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend+ (green)	893200	All Airway modules
Sampling line 2.0 m	733162	Compact Airway Module, M-COVX
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001759.

1.4.3 PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX with CO2 absorber - Anesthesia

Part	Order No.	For product(s)
Special tube (Nafion 2 pcs)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001760.

1.4.4 PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX with CO2 absorber - Critical Care

Part	Order No.	For product(s)
Special tube (Nafion 2 pcs)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend+ (green)	893200	All Airway modules
Sampling line 2.0 m	733162	Compact Airway Module, M-COVX
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001761.

1.4.5   PM parts for Airway Module, E-miniC/ M-miniC

Part	Order No.	For product(s)
Special tube (Nafion 2 pcs)	733382	All Airway modules
Mini D-fend O-ring (2 pcs)	656565	E-miniC/ M-miniC
Mini D-fend	8002174 (pkg of 10 pcs)	E-miniC/ M-miniC
Zero valve air filter	M1011471	E-miniC, every 3 years
Zero valve air filter	571421	M-miniC
CO2 Sampling line 3.0 m	733163	E-miniC/ M-miniC
PM sticker	893108	All Airway modules

For details on recommended accessories see the "Supplies and Accessories" catalog.

2   Planned maintenance check list

2.1   Visual inspection/preparation

2.1.1   General

NOTE: Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.

Make sure that the monitor is switched to standby.

Disconnect the mains power cord. If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from the monitor. Disconnect the WLAN antenna card, if the Wireless LAN option is installed.

1.   Check all the units visually. Check that all parts are intact and that the cables and screws are connected and tightened properly.

Especially check the following parts:

–   the equipotential tap and all the screws are tightened properly.

–   the display unit locking screw is in a locking position.

Check that modules go in smoothly and lock up properly in all module slots.

Insert the WLAN antenna card back into the foremost card slot, if the Wireless LAN option is installed.

2.   Replace the batteries, if necessary.

The manufacturer recommendations are:

–   Replace the SRAM/Timekeeper battery on the CPU board every 8 years.

NOTE: The Factory Reset must be performed if the SRAM/Timekeeper battery is replaced.

NOTE: If the monitor is used for frequent short transportation, refresh the batteries every two weeks and replace the batteries every six months.

3.   Clean or replace the fan filters in the frame unit and display unit.

4.   Check that the fuses are of the correct rating.

2.1.2   Compact Airway Module, E-CXXXXX/ M-CXXXXX

1.   Detach the module box.

Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

NOTE: The tubes connected to the Oxygen board pressure transducers should not be pressed too deep.

NOTE: Make sure that the tubes are not in contact with the sampling pump or the O_2 sensor, or its springs.

2.   Install the PM Kit:

–   Replace the special tubes (Nafion™).

–   Replace the Ref. filter assembly.

–   Replace the filters in the pneumatic unit (1 or 2 pcs).

  – Check the D-fend O-rings and replace them, if necessary.

  – Replace the D-fend and sampling line.

  – Clean or replace the fan filter.

  NOTE: Use only approved sampling lines to ensure proper functioning.
  Use a 2 m/7 ft. sampling line with Compact Airway Modules E-/ M-COVX and E-/ M-CAiOVX.

3. The manufacturer recommendation is to replace the CO_2 absorber every 4 years. Replace the absorber, if necessary.

  Note: All Compact Airway Modules do not contain a CO_2 absorber.

✍

  Connect the Compact Airway Module to a module slot with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

2.1.3 Single-width Airway Module, E-miniC/ M-miniC

1. Detach the module box.

2. Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

3. Install the PM Kit:

  – Replace the special tube (Nafion™).

  – Replace the Zero valve air filter every three years.

  – Check the D-fend body connector O-rings and replace them, if necessary.

  – Replace the Mini D-fend and the sampling line.

  NOTE: Use only approved sampling lines to ensure proper functioning.

4. Connect the module to a module slot with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

✍

2.1.4 Tonometry Module, E-TONO/ M-TONO

1. Detach the module box.

  Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

2. Replace the Special tube (Nafion 2 pcs).

  Reattach the module box and check that the latch moves properly. Plug the module back into the module frame.

✍

2.1.5 Recorder Unit

1. Clean the recorder.

  – Open the paper compartment hatch and remove the paper roll, if installed.

  – Remove any paper chaff from the paper compartment.

—   Clean the thermal printhead and the small glass window in front of the static brush with a cotton swab dipped in isopropyl alcohol, if necessary.

NOTE: Avoid contact with the rubber paper roller. Be careful to limit the application of alcohol to the thermal printhead and the window.

—   Reinstall the paper roll.

2.1.6   Modules with NIBP measurement

1.   Check the NIBP pump filter. Replace the filter, if necessary.

Note: M-NIBP Rev. 00-03 do not contain a NIBP pump filter.

Plug the module back into the frame.

2.2   Functional inspection

2.2.1   General

1.   Connect the mains power cord. Check that the LED above the mains switch is lit continuously (full charged batteries) or periodically (charging batteries).

2.   Switch the monitor on.

Check that the monitor starts up properly, i.e. the alarm LEDs and the display unit fan turn on shortly, normal start-up sound is heard from the loudspeaker and the monitoring screen appears.

No error messages should appear on the screen.

3.   Configure the screen for the parameters that are connected.
Check that all the connected modules are recognized, i.e. the required parameter information is shown on the screen.

If installed, the recorder should record two lines of start-up information.

Preset the measurement settings for those parameters that are connected, for example:

Others - *EEG - Montage - EEG Channels - 4*
- Montage type - Bip
Others - *EEG - EEG Setup - Numeric 1 - MF*
                              - Numeric 2 - Ampl.

Others - *EP - Cycle - Cont.*
            - AEP Setup - AEP Channels - 2
            - Responses -100
            - Stim. Frequency - 1.1Hz
            - Stim. Intensity - 90 dB
            - Sweep length - 100 ms
            - EP size - 1

Recorder - *Record Waveforms - Waveform 1 - ECG1*
                               - Waveform 2 - P1
                               - Waveform 3 - P2

Invasive Pressures - *P1 'ART' Setup - Label - ART*
                               - P2 'CVP' Setup - Label - CVP
                               - P3 Setup - Label - PA
                               - P4 Setup - Label - P4
                               - P5 Setup - Label - P5
                               - P6 Setup - Label - P6

Pulse Oximetry - *Pleth Scale - AUTO*
or
Others - *SPO2 Setup - Pleth Scale - AUTO*

Airway Gas - *Spirometry View - Scaling - Indep.*
                               - Paw Scale - 20
                               - Flow Scale - 15

or

Ventil. - *Spirometry Setup - Scaling - Indep.*
                               - Paw Scale - 20
                               - Flow Scale - 15

Others - *C.O. View - C.O. Setup - Scale - 1.0 °C*
                               - Injectate Volume - 10 ml
                               - Measurement Mode - SET

Others - *SvO2 - Update HGB - 115 g/l*

or

Wedge C.O: SVO2 - *C.O. View - C.O. Setup   - Scale - 1.0 °C*
                               - Injectate Volume - 10 ml
                               - Measurement Mode - SET

Wedge C.O: SVO2 - *SvO2 - Update HGB - 115 g/l*

Others - *NMT - Stimulus Mode - TOF*
                   - Set Cycle Time - 10 sec.
Others - *NMT -NMT Setup   - Current - s(70mA)*
                               - Pulse Width - 200 ms
                               - Stim. Beep Volume - 2
Others - *Resp Setup   - Size - 1.0*
        - Resp Rate Source - AUTO
        - Measurement - ON
        - Detection Limit - AUTO

2.2.2   Display

1.   Check that the picture on the screen is adjusted correctly.

2.2.3   Keyboard(s)

1.   Tests with the Command Board:

–   Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.
Check the rest of the menu keys by pressing them one by one.

Tests with the ARK Keyboard:

–   Enter the ***Keyboard*** service menu

–   Check the function of the ComWheel.

–   Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the 'Message count' value in the service menu increases.

–   Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

Tests with the Remote Controller:

–   Enter the ***Keyboard*** service menu.

–   Check the function of the ComWheel.

–   Press all keys. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

2.2.4   Display Unit

1.   Check that the clock on the screen shows correct time.

Readjust the time and date, if necessary.

2.   Enter the ***Service Log*** service menu.

Check the content of the Service Log for possible problems.

2.2.5   Frame Unit

1.   Check that the Frame unit fan is running.

2.2.6   Compact Airway Module, E-CXXXXX/ M-CXXXXX

1.   Check that the fan is running.

2.   If the module contains membrane keys on the front panel, press each of the keys for at least one second and check that they are identified.

NOTE: The Compact Airway Module membrane keys require S/5 main software.

3. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Compact Airway Module *General* service menu.

   Check that the module configuration displayed corresponds with the Compact Airway Module type being used.

4. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.

5. Enter the *Gases* service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).

6. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.

7. Perform a sampling system leak test.

8. Check the flow rates. Adjust the sampling flow, if necessary.

9. Perform a gas calibration:

   NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

   NOTE: For correct measurement values, modules need different amounts of oxygen in the calibration. If you do not use the recommended calibrating gases, the calibration does not succeed.

   ✍

Anesthesia Agent

Compact Airway Modules w/ the option

10. Enter the *Gases* service menu.

    Feed calibrating gas (order code 755583) continuously for at least 30 seconds and check that the 'ID' in the service menu shows 'DES' and that the value for 'ID unrel.' is lower than 50.

    ✍

Patient Spirometry

Compact Airway Modules w/ the option

11. Enter the *Spirometry* service menu.

    Connect a clean spirometry tube and D-lite to the module.

    Perform the spirometry leak test.

12. Connect the sampling line. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in, and upwards when you breathe out.

    ✍

General

For all Compact Airway Modules

- Switch the monitor to standby and reassemble the module.

  NOTE: Attach the plastic cover to the CPU Board before fitting the module box. Make sure that the grounding claws in the front panel frame make good contact with the module box.

NOTE: When reassembling the module, make sure that the tubes are not pinched between the module box and internal parts.

Insert the Compact Airway Module into the frame. Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.

13. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.

14. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 60 seconds.

2.2.7 Single-width Airway Module, E-miniC/ M-miniC

1. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Gas Unit *General* service menu.

    NOTE: The Airway Module M-miniC requires S/5 main software L-CANE02(A) / L-CICU02(A) or later.

2. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.

3. Enter the *Gases* service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).

4. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.

5. Perform a sampling system leak test.

6. Check the flow rates. Adjust the sampling flow, if necessary.

7. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.

    Remove the Mini D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.

8. Perform a gas calibration:

    NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

2.2.8 Tonometry Module, E-TONO/ M-TONO

1. Enter the *TONO* service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.

    Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

    Check that the 'general error status', 'module pneumatics error status', 'module hardware error status' and 'testbit status' are all zero.

2. Check the function of the front panel **Start-Stop** and **Lab Data** membrane keys.

3. Perform the pressure sensor calibration.

4. Perform the system test.

5. Perform the gas calibration.

6. Connect the catheter to the module. Start measurement by pressing the **Start-Stop** key on the module. Check that the catheter fills up.

   Stop the measurement by pressing the **Start-Stop** key. Check that Meas. Off text appears in the digit field.

   ✍

2.2.9   Multiparameter Hemodynamic Modules

ECG and RESP measurements

1. Enter the *ESTP: ECG* service menu.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the ECG/RESP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the front panel membrane key **ECG LEAD,** if available.

3. Check that the 'Power Freq' value is set according to the mains power frequency. Correct the setting, if necessary.

4. Connect a 3-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

   Connect a 12-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

5. Modules without the 12-lead capability (M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR and M-NESTR modules): connect a 5-lead ECG cable to the module. Connect the cable leads to a patient simulator.

   Check that the 'Cable type' shows 5 lead.

6. Disconnect one of the leads and check that the corresponding electrode in the service menu shows OFF within 10 seconds from the disconnection, then reconnect the lead.

   Check the rest of the leads using the same method.

   NOTE: With NESTPR/ESTPR type modules: when the ground lead (black) is disconnected, all the electrodes should show OFF. With M-NE12STPR, M-PRESTN, E-PRESTN and E-PSM: when any of the limb leads is disconnected, the measurement will automatically change to 3 electrode ECG measurement.

   NOTE: The asystole and different leads off messages are shown using certain priority. Even though one of the leads is disconnected, the related leads off message may not appear on the screen.

   NOTE: When RA, LA, LL or RL electrode is disconnected, all V electrodes show OFF.

   NOTE: With NESTPR/ESTPR type modules and 5 lead cable, the state of V2, V3, V4, V5 and V6 electrodes follow the state of the V electrode.

7. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Check that the pacer count value in the service menu is shown according to the simulator configuration.

   Change baseline impedance on the simulator and check that appropriate RESP waveform and RR values are shown again within 30 seconds.

Turn the simulator off. Check that the 'Asystole' and 'Apnea' messages are displayed.

Temperature measurement

8.   Enter the ***ESTP: STP*** service menu.

Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the STP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

9.   Check the temperature measurement calibration using temperature test plugs.

NOTE: Make sure that the protection for temperature calibration is set on, if calibration is needed.

Invasive blood pressure measurement

10.   Check the function of the module front panel membrane keys.

11.   Check the InvBP channels with a patient simulator.

Zero the InvBP channels, then check that the values and waveforms correspond to the simulator settings.

SpO2 measurement

12.   Check that the message 'No probe' is shown, when no SpO$_2$ sensor is connected.

Connect an SpO$_2$ finger probe to the module. Check that the message 'Probe off' is shown, when the probe is not connected to a finger.

13.   Attach the SpO$_2$ probe to your finger. Check that a reading of 95-99 and a pleth waveform appear on the screen.

Non invasive blood pressure measurement

14.   Enter the ***NIBP*** module service menu.
Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NIBP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show ***OK***.

15.   Check the function of the front panel membrane keys.

16.   Check the NIBP tubing system for leakages by performing ***Calibrations - Active leak test.***

17.   Perform NIBP calibration by selecting ***Calibration.***

18.   Enter the ***Pneumatics*** service menu.
Check the NIBP watchdog timer activation pressure with a pressure manometer.

19.   For Modules M-ESTPR and M-NE(12)STPR: Check the NIBP watchdog timer by performing ***Watchdog – Test Adult*** and ***Test Infant***.

20.   Check the safety valve by performing ***Safety Valve – Adult*** and ***Infant.***

21. Attach an adult NIBP hose and cuff onto your arm and perform one NIBP measurement. Check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

    Check that the module gives a reasonable measurement result.

E-PSM(P), E-PRESTN:

22. Attach a NIBP cuff hose without cuff identification and check that the module identifies the hose:

    – The message 'Select inflation limits' appears in the NIBP digit field.

    – When you try to start the measurement, the monitor automatically opens the selections *NIBP Setup - Inflation Limits*.

✐

2.2.10 EEG Module, E-EEG/ M-EEG and EEG Headbox, N-EEG

1. Enter the *EEG & EP* service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

    Check that the HB Mod Time-outs, HB Mod Bad Checksum and Mod HB Bad Checksum values are not increasing faster than by 5 per second. Check that the memory of the headbox has passed the internal memory test, i.e. HB Rom Error in the headbox view states 0.

2. Check the **EP Start/Stop** and **Imp. Check** membrane keys both in the module and the headbox.

3. Connect the EEG simulator to the headbox. Select 10 kΩ as imped. pos. and imped. neg. value on the simulator. Go to *EEG & EP* service menu and select *Check Electr.* Check in the headbox view that the impedances in all four channels are 10 kΩ $\pm$1 kΩ.

4. Select 2 kΩ as imped. pos. and imped. neg. value on the simulator. Select 10 Hz 200 μV sinewave on the simulator and check that all the four waveforms have the same form. Check that the size of the waveforms is 200 μV_{pp} $\pm$5 V. Check that the MF value is 10 $\pm$0.5 Hz. Check that the amp value is 71 μV $\pm$3 μV.

5. Plug in the earphones to the headbox.

    NOTE: Be careful with loud stimulation from the earphones when starting AEP stimulation.

    Start AEP stimulation by pressing the **EP Start/Stop** button on the module. Check that the clicking sound comes from the earphones in 1.1 Hz frequency. Stop the stimulation by pressing again the **EP Start/Stop** button on the module. Check that the clicking stopped.

✐

2.2.11 BIS Module, E-BIS/ M-BIS

1. Enter the *BIS* service menu:

    Check that the DSC is connected to the module and the PIC+ cable is connected to the DSC.

    Check that the Mod Mon Time-outs, Mon Mod Bad checksums, Mod Mon Bad Checksums and Bad Checksums from BIS values in the module view are not increasing faster than by 5 per second.

Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the **BIS** and **Sensor Check** membrane keys of the module. Stay in the module view and press each key for at least one second and check that the key being pressed is identified, i.e. the corresponding 'PUSHED' text appears in the service menu.

3. Check that 'Messages from BE' are increasing steadily.

   Enter the *Sensor* menu.
   Check that

   - sensor type indicates 'No Sensor' (i.e. no sensor is identified)
   - no sensor is identified
   - mains frequency is set correctly
   - check that 'BE powerup test', 'DSC selftest Ch1' and 'DSC selftest Ch2' all show 'PASSED'

   (if not, go to **BIS Setup** menu, perform DSC Test and check the results again)

4. Connect the BIS simulator to the PIC+ cable. See that 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show 'PASS'. Check that the 'Sensor type' shows correct information.

5. Check that the 'BIS', 'SQI' and 'SR' values are between 0...1000, and the 'EMG' value between 0...10000.

   NOTE: If Sensor Simulator 900508 is used, the values can be out of the given range.

6. Enter the *Module* menu.

   Check that no BIS engine errors appear.

   Perform sensor check by pressing **Check Sensor** and see that the check is passed.

   During the sensor check the Impedance meas. should show 'CYCLIC'. During operation the Impedance meas. should show 'COMBINED' or 'OFF' (depending on the user setting in **BIS Setup** menu).

   ✎

2.2.12 Entropy Module, E-ENTROPY/ M-ENTROPY

1. Enter the *Entropy* service menu.

   Check that the Entropy sensor cable is connected to the module.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the **Entropy** and **Check Sensor** membrane keys of the module. Stay in the module view and press each key for at least one second and check that the key being pressed is identified, i.e. the Check Sensor text is highlighted in the service menu and that pressing the **Entropy** key brings up the *Entropy* menu.

3. Connect the Entropy simulator (N-ES) to the cable. See that the 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show "PASS".

4. Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

   ✎

2.2.13 Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT

1. Enter the *P/PT* module service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the PT board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

    ✍

Invasive blood pressure measurement

2. Check the function of the front panel **Zero P3** membrane key.
3. Check the InvBP channel with a patient simulator.

    Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

    ✍

Modules w/ temperature measurement

4. Check the temperature measurement calibration using temperature test plugs.

    NOTE: Make sure that the protection for temperature calibration is set on.

    ✍

2.2.14 Dual pressure Module, E-PP, M-PP

1. Enter the *PP* module service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the Dual Pressure module, E-PP or M-PP, memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.
2. Check the function of the front panel **Zero P5** and **Zero P6** membrane keys.
3. Check the InvBP channels with a patient simulator.

    Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

    ✍

2.2.15 Cardiac Output Modules, E-COP, E-COPSv, M-COP, M-COPSv

1. Enter the *COP* module service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

    ✍

Invasive blood pressure measurement

2. Check the function of the front panel membrane **Zero P4** key.

3. Check the InvBP channel with a patient simulator.

    Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

    ✑

SvO$_2$ measurement

4. Check that the SvO$_2$ values Meas. state, OM fail and OM temp. in the **COP** module service menu all show NO OM.

5. Checks with the SvO$_2$ simulator:

    Turn the SvO$_2$ simulator pulsation switch to Medium and the range switch to Normal pulse. Connect the simulator to the module and check that the following messages appear in the digit field for SvO$_2$:

    Initializing, please wait > Warming up > Not calibrated

    Check that 'Meas. state' has changed to **NORMAL** and 'OM fail' and 'OM temp.' show OK.

    NOTE: The 'OM temp.' may show **UNSTABLE** at first, but the message should change to OK within a half a minute.

6. Perform an In Vitro calibration with the SvO$_2$ simulator.

    Check that the calibration date for In Vitro calibration was updated correctly and the SvO$_2$ reading on the screen is 81% (±2%).

    ✑

Cardiac Output measurement

7. Enter the **COP** module service menu.

    Check the front panel **Start C.O.** membrane key.

8. Enter the **C.O. View** menu:

    Others - **C.O. View**

    Connect a catheter connecting cable to the module connector C.O.

    If the module contains a C.O. Test connector (M-COP), attach the catheter connector of the connecting cable to the C.O. Test connector. Check that the message 'Cable OK' appears in the menu after the self-test.

    No Catheter > Self Test in Progress > Cable OK

9. Check the C.O. measurement with a patient simulator.

    ✑

2.2.16 NIBP module, M-NIBP

1. Enter the **NIBP** service menu:

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NIBP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

2. Check the front panel LEDs and membrane keys using the **Buttons/Leds** service menu.

3. Check the NIBP tubing system for leakages by performing ***Active leak test.***

4. Perform NIBP calibration by selecting ***Calibration***.

5. Enter the ***Pneumatics*** service menu.

   Check the NIBP watchdog timer activation pressure with a pressure manometer.

6. Check the NIBP watchdog timer by performing ***Watchdog – Test Adult*** and ***Test Infant***.

7. Check the safety valve by performing ***Safety Valve – Adult*** and ***Infant***.

8. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

   Check that the module gives a reasonable measurement result.

   ✎

2.2.17 NeuroMuscular Module, E-NMT, M-NMT

1. Enter the ***NMT*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the function of the front panel membrane keys **Start-Up** and **Stop/Continue**.

3. Check that the message 'Cable off' is shown in the digit field and that 'Cable' on the service menu states ***OFF***.

   Plug the NMT Sensor Cable with the NMT ElectroSensor into the front panel connector NMT. Check that the message in the digit field changes to 'Measurement OFF' and 'Cable' in the service menu states ***EMG*** and ***ELECTR. OFF***.

4. Place a 3 kΩ resistor between the ElectroSensor's stimulus electrode leads (brown and white). Perform ***Start Curr. Test.***

   Check that the test was successful, i.e. the 'Current test (mA):' in the menu states ***30 OK, 50 OK*** and ***70 OK***.

   Connect the ElectroSensor leads to the NMT simulator. Set the switch on the simulator to FADE OFF and turn the knob to MAX. Check that 'Cable' in the service menu states now only ***EMG***.

5. Start the NMT measurement (TOF) by pressing the **START-UP** key on the module.

   Check that the found supramaximal current is less than 70 mA, i.e. the 'Current set' value in the service menu is less than 700.

6. Check that the digit field TOF% value is within 95-105, Count is 4 and T1% is within 95-105.

7. Check that the Noise value in the service menu remains under 100.

   ✎

2.2.18 Nellcor Compatible Saturation module, E-NSAT, M-NSAT

1. Enter the ***M-SAT*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NSAT module's ROM memory has passed the internal memory test, i.e. ROM shows OK.

   Check that all three error indicators, Preamp Error, QUART Error and I/O Error state NO.

2. Check that the SpO$_2$ probe related status information in the menu is correct. Only the 'NoProbe' should be active (1), when no probe is connected.

3. Connect a Nellcor SpO$_2$ finger probe to the module. Check that the message 'Pulse search' is shown and the corresponding status information in the menu is active. Check that the shown message changes to 'Check probe' within 30 seconds.

4. Attach the SpO$_2$ probe on your finger. Check that a reading of 95-100 and a proper SpO$_2$ waveform appear.

2.2.19 Datex-Ohmeda Oxygen Saturation module, M-OSAT

1. Enter the *M-SAT* service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check also that the module's ROM memory has passed the internal memory test, i.e. the ROM shows *OK*.

2. Check that the message 'No probe' is displayed on the screen when no probe is connected.

3. Connect a suitable SpO2 finger probe to the module. Check that the message 'Check probe' is displayed on the screen within 30 seconds.

4. Attach the SpO$_2$ probe on your finger. Check that a reading of 95-100 and a proper SpO$_2$ waveform appear.

2.2.20 Memory

1. Enter the *MemCards* service menu:

   Check that the memory unit is recognized properly, i.e. Present and Active state YES.

2. Check that the memories and the PCMCIA controller have passed the tests. The status for each should be OK.

3. Select *Communication*.

   Check that the Interface status states Active continuously and the error counter values on the bottom part of the menu are stable.

4. Select *Status*.

   Insert Data card into the slot.

   Wait until the information is fully updated in the service menu, then check that the Card types are correct and the 'File system' states ATA.

   Check that the rest of the information is reliable and no errors have been detected.

2.2.21 Recorder

1. Open the paper compartment cover. Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.

2. Press the **Record Wave** key and check that the module starts recording the selected waveforms. Press the **Stop** key again to stop recording.

3. Check that the quality of the recordings is acceptable.

✍

2.2.22 Network Option

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the frame unit. Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

   NOTE: If necessary, reselect the monitor's network communication according to the used network software in the **Network** service menu.

2. Enter the **Ethernet** service menu:

   Check that the counters for data errors (CRC, Frame, Transm.) are stable.

   Check that the counters for hardware errors (Intern., Missed, FIFO, Overrun) all show 0.

✍

2.2.23 Wireless Network Option

1. Check that the green LED on the wireless antenna card blinks and the WLAN signal strenght symbol scrolls between zero and full or stays fixed on the monitor screen.

2. Check that the wireless LAN network symbol appears on the upper right-hand corner of the screen when the monitor connects to the Datex-Ohmeda Network,

NOTE: If the monitor does not connect to the Datex-Ohmeda Network, check the WLAN configuration on the monitor and on the network.

✍

2.2.24 Interface Module, E-INT, M-INT

1. Enter the **Interface** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the memories have passed the internal memory test, i.e. RAM and ROM state OK.

✍

2.2.25 Device Interfacing Solution, N-DISxxx

1. Enter the **DIS Interfacing** service menu:

   Check that the DIS module 'tout' and 'cse' values do not increase faster than by 5 per second. Check also that the DIS module memories have passed the internal memory test, i.e. Ram, Rom and EEPROM state all OK.

Perform the same check for all connected DIS modules.

2.2.26 General

1. Storing trend data

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby situation with no power cord.

2. Service reset

    Check the Service Reset switch. Switch the monitor to standby and press the Service Reset switch for at least five seconds. Switch the monitor back on and check that the monitor performs a Cold Start, i.e. all trend information is cleared.

3. Watchdog

    Enter the **Set/Test** service menu and perform **Watchdog**.

    Check that the monitor restarts.

4. Service Log reset

    Enter the **Service Log** service menu.

    Clear the content of the Service Log by selecting **Reset Log** from the menu.

5. Electrical safety check

    Perform an Electrical safety check and a leakage current test.

    Check that the monitor and all connected units function normally after the performed test.

6. Final cleaning

    Switch the monitor to standby and perform final cleaning.

    Fill in all necessary documents.

APPENDIX A   Planned maintenance check form, S/5 Compact Monitors

Customer	
Service	
Service engineer	Date

Monitor Installation			
Frame: F-CM_____	System options:	E/M-	
Software:	N-	E/M-	
K-	N-	E/M-	
K-	N-	E/M-	

OK = Test OK   **N.A. = Test not applicable**   **Fail = Test failed**

Visual Inspection		OK	N.A.	Fail
2.1.1. General		☐	☐	☐
2.1.2. Compact Airway Module, E-CXXXXX/ M-CXXXXX	S/N	☐	☐	☐
2.1.3. Single-width Airway Module, E-miniC/ M-miniC	S/N	☐	☐	☐
2.1.4. Tonometry Module, E-TONO/ M-TONO	S/N	☐	☐	☐
2.1.5. Recorder Unit	S/N	☐	☐	☐
2.1.6. Modules with NIBP measurement	S/N	☐	☐	☐
	S/N	☐	☐	☐
		☐	☐	☐
Notes				

Functional Inspection		OK	N.A.	Fail
2.2.1. General		☐	☐	☐
2.2.2. Display		☐	☐	☐
2.2.3. Keyboard(s)		☐	☐	☐
2.2.4. Display Unit		☐	☐	☐
2.2.5. Frame Unit		☐	☐	☐
Notes				
2.2.6. Compact Airway Module, E-CXXXXX/ M-CXXXXX		☐	☐	☐
. Anesthesia Agent		☐	☐	☐
. Patient Spirometry		☐	☐	☐
. General		☐	☐	☐
Notes				
2.2.7. Single-width Airway Module, E-miniC/ M-miniC		☐	☐	☐
Notes				
2.2.8. Tonometry Module, E-TONO/ M-TONO		☐	☐	☐
Notes				
2.2.9. Multiparameter Hemodynamic Modules		☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SpO2 measurement		☐	☐	☐
. Non invasive blood pressure measurement		☐	☐	☐
. E-PSM(P), E-PRESTN:		☐	☐	☐
Notes				

Functional Inspection		OK	N.A.	Fail
2.2.10. EEG Module, E-EEG/ M-EEG and EEG Headbox, N-EEG		☐	☐	☐
2.2.11. BIS Module, E-BIS/ M-BIS		☐	☐	☐
2.2.12. Entropy Module, E-ENTROPY/ M-ENTROPY		☐	☐	☐
Notes				
2.2.13. Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Modules w/ temperature measurement		☐	☐	☐
Notes				
2.2.14. Dual pressure Module, E-PP, M-PP		☐	☐	☐
Notes				
2.2.15. Cardiac Output Modules, E-COP, E-COPSv, M-COP, M-COPSv		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SvO2 measurement		☐	☐	☐
. Cardiac Output measurement		☐	☐	☐
Notes				
2.2.16. NIBP module, M-NIBP	S/N	☐	☐	☐
2.2.17. NeuroMuscular Module, E-NMT, M-NMT	S/N	☐	☐	☐
2.2.18. Nellcor Compatible Saturation module, E-NSAT, M-NSAT	S/N	☐	☐	☐
2.2.19. Datex-Ohmeda Oxygen Saturation module, M-OSAT	S/N	☐	☐	☐
2.2.20. Memory	S/N	☐	☐	☐
2.2.21. Recorder	S/N	☐	☐	☐
2.2.22. Network Option	S/N	☐	☐	☐

Functional Inspection		OK	N.A.	Fail
2.2.24. Interface Module, E-INT, M-INT	S/N	☐	☐	☐
2.2.25. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
Notes				
2.2.26. General		☐	☐	☐
1. Storing trend data		☐	☐	☐
2. Service reset		☐	☐	☐
3. Watchdog		☐	☐	☐
4. Service Log reset		☐	☐	☐
5. Electrical safety check		☐	☐	☐
6. Final cleaning		☐	☐	☐
Notes				

Used spare parts			
Notes			

Signature

Datex-Ohmeda

S/5™ Compact Anesthesia Monitor
S/5™ Compact Critical Care Monitor

Monitor Software L-CANE05(A) and L-CICU05(A)

Service Menu

```
┌─────────────────┬──────────────────────────────┐
│ Service Menu    │  Sw version / Unit id         │
│                 │                               │
│ Frame       ▦   │  Main Software -------------- │
│ Display     ▦   │  L-CANED5A.DD.EN/DE M1D41361-19.D │
│ Keyboard    ▦   │  2DD5-D6-D2                    │
│ Parameters  ▦   │  SW serial number: ---------- │
│ Set / Test  ▦   │  7                             │
│ Service Log ▦   │  BootLoader Software --------- │
│ Scroll Vers     │  Ver MD1D7327-4.D 2DD4-D3-24   │
│ Record Vers     │  CPU serial number:---------   │
│ Record Data ▦   │  92117613                      │
│ Remote Access▦  │  CPU test date: code: level: - │
│ Previous Menu   │  2DD4-D8-2D BDD1596 D4         │
│                 │  PLD level: ----------------- │
│                 │  2                             │
│                 │  PMB version number: -------- │
│                 │  1.5                           │
│                 │  Frame number: -------------- │
│                 │                               │
│                 │  Keyboard 1 ----------------- │
│                 │  ?                             │
│                 │                    -More-     │
└─────────────────┴──────────────────────────────┘
```

All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

Table of contents

List of tables

Introduction

The monitor has a **Service Menu**, which is a useful tool to examine monitor functions and to troubleshoot in case a fault occurs.

Service Menu structure
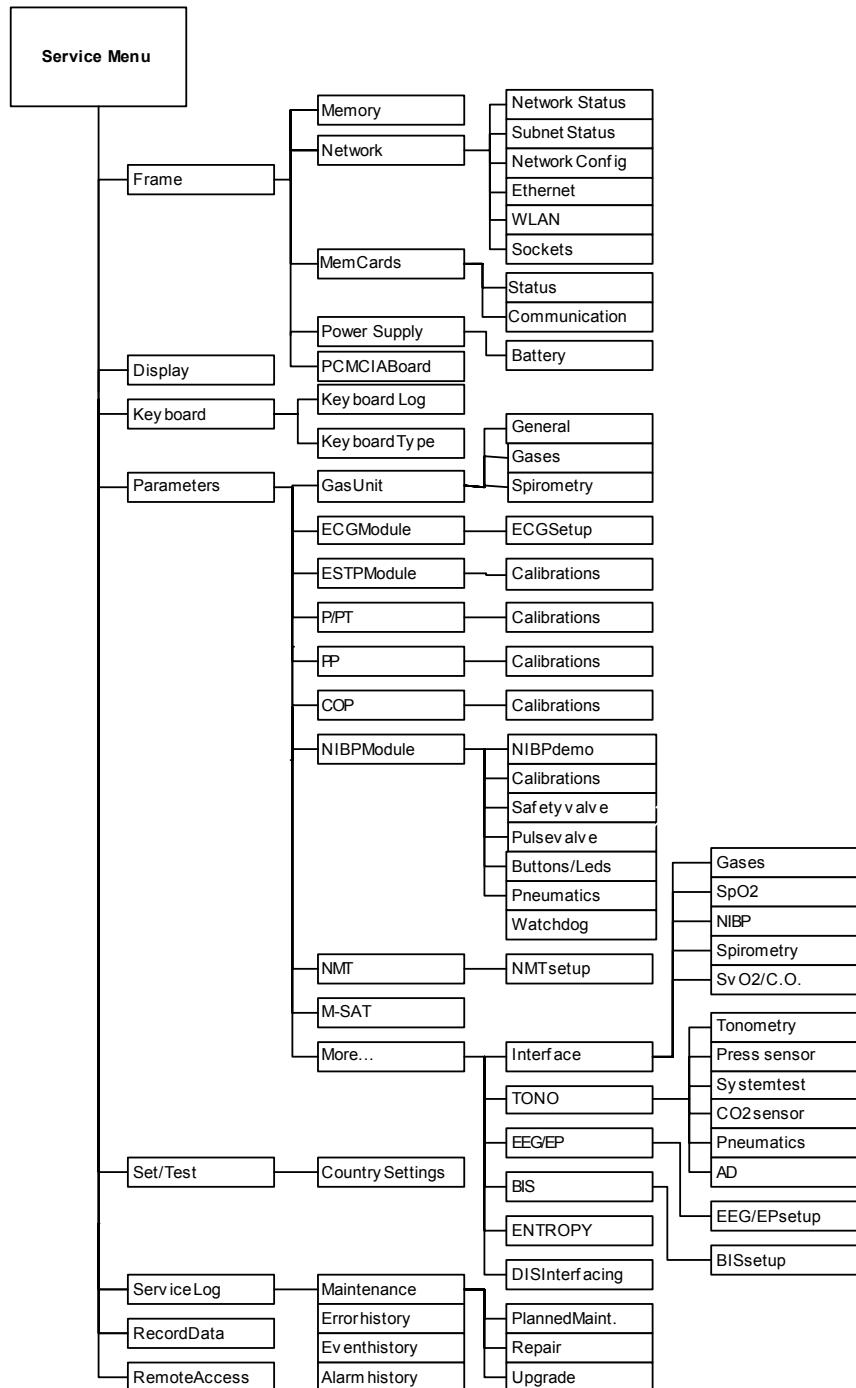
servmenu_struct03_CAM.vsd

Service Menu

NOTE: The Service Menu pictures are for reference only. Details on the menu page can vary depending on the software version and the module type in use.

1. Press the **Monitor Setup** key.
2. Select *Install/Service* (password 16-4-34).
3. Select *Service* (password 26-23-8).

```
┌─────────────────────┬──────────────────────────────┐
│ Service Menu        │ Sw version / Unit id         │
│                     │                              │
│ ┌─────────────────┐ │                              │
│ │ Frame        ▦ │ │ Main Software -------------- │
│ └─────────────────┘ │ L-C ANED5A..DD.EN/DE M1D41361-19.D │
│                     │ 2DD5-D6-D2                    │
│ Display         ▦  │ SW serial number: ---------- │
│                     │ 7                            │
│ Keyboard        ▦  │ BootLoader Software --------- │
│                     │ Ver MD1D7327-4.D '2DD4-D3-24 │
│ Parameters      ▦  │ CPU serial number:---------- │
│                     │ 92117613                     │
│ Set / Test      ▦  │ CPU test date:  code: level: ------- │
│                     │ 2DD4-D8-2D 8DD1596 D4        │
│ Service Log     ▦  │ PLD level: ----------------- │
│                     │ 2                            │
│ Scroll Vers        │ PMB version number: -------- │
│                     │ 1.5                          │
│ Record Vers        │ Frame number: -------------- │
│                     │                              │
│ Record Data     ▦  │ Keyboard 1 ----------------- │
│                     │ ?                            │
│ Remote Access   ▦  │                    -More-    │
│                     │                              │
│ Previous Menu      │                              │
└─────────────────────┴──────────────────────────────┘
```

1   Frame

The frame menu includes service menus common for the frame.

```
Service Menu │  Sw version / Unit id
            │
        Frame
                              ----------------
    Memory  ▦          M1005810-18.0
    Options Net+DC
                              ----------------
    Network ▦
    MemCards ▦         )-10-25
                              ----------------
    Power Supply ▦
    PCMCIA Board ▦     e: level: -------
                       )0
    Frame Number ▦
                              ----------------
    Previous Menu
                              ----------------

                              ----------------

                              ----------------
                                        -More-
```

1.1   Memory

A service menu to check the status of the memory used in the CPU board of the monitor.

Test Memory tests the condition of the EEPROM/Flash memory component of the CPU board. If the result of the test is **Fail**, see section "Error messages" in the Display unit slot.

Test SRAM tests the Static RAM memory of the CPU board in a similar way as the EEPROM/Flash memory. If the result of the test is **Fail**, see section "Error messages" in the Display unit slot.

Real-time clock test is run at every start up and also during the operation of the monitor. If the result of the test is **Fail**, the battery for the SRAM timekeeper should be replaced.

```
  Memory      │      Service Data

Test Memory   │  EEPROM/Flash
Test SRAM     │  Test ?
Previous Menu
                  Static RAM
                  Test ?


                  Real-time clock   OK
```

1.2   Network

1.2.1   Network Status

The Network Status view shows the general status of the network

Location ID: Monitor's location given at the setup.

DRI level: Shows the selected level of network communication. The network communication is set according to the network software used (e.g. S-CNET01)

Interfaces: The field indicates if there is a connection to the Datex-Ohmeda Network

Gateway Interface: The field indicates the active network interface (None/Ethernet/WLAN)

Connections: Names of subnet id:s connected

The field represents the subnet status menus, i.e. shows the connected subnets. The three first connections are reserved permanently for Datex-Ohmeda Central, and the fourth is reserved for another subnet, e.g. Datex-Ohmeda S/5 Arrhythmia Workstation.

```
 Network          Network Status

Network Status    Location ID      0

Subnet 1 status   DRI Level        2002

Subnet 2 status   Interfaces
                    Ethernet       Not Connected
Subnet 3 status     WLAN           Connected

Subnet 4 status   Gateway Interface  WLAN

Config        ▤
                  Connections
Ethernet      ▤

WLAN          ▤

Previous Menu
```

Subnet Status

The Subnet status view gives more accurate information of the different subnet id:s connected. All four **Subnet status** menus have a similar structure. The number of different packets transmitted and received by the monitor are shown in the columns below Tx and Rx. The packet types are:

Waveforms: Waveform data

Phys. data: Physiological numerical data

Alarms: Alarms, alarm profiles and alarm limits

Link mgmt: Network management messages

Record K: Record Keeper data

MonToMon: Monitor-to-monitor communication related data

Printer: Printing data and control messages

File Op.: File operation messages, saving and loading of cases

Service: Maintenance and service

Modes: User mode data

Indics.: Remote indications sent to monitor

RemoteEv: Remote events

Data server: Packets of the data server (Arrhythmia Workstation)

Packets total: Total number of packets sent/received

Bytes total: Total number of bytes sent/received

T-o Number or resendings

InE Received faulty packets

LenE Erroneous packet length

Dupl Same packet received as a duplicate

```
Network          Subnet 1 status

Network Status
                                  Tx        Rx
Subnet 1 status      Waveforms         0         0
                     Phys. data        0         0
Subnet 2 status      Alarms            0         0
                     Link mgmt         0         0
Subnet 3 status      Record K          0         0
                     MonToMon          0         0
Subnet 4 status      Printer           0         0
                     File Op.          0         0
Config       ▤       Service           0         0
                     Modes             0         0
Ethernet     ▤       Indics.           0         0
                     RemoteEv          0         0
WLAN         ▤       Data server       0         0
                     Packets total     0         0
Previous Menu        Bytes total       0         0

                     T-o  InE  LenE Dupl
                      0    0    0    0
```

1.2.2 Network Config

The DRI Level is for setting the monitor's network communication. The network communication is set according to the network software used (e.g. S-CNET01).

Network software S-CNET01 ->DRI Level = 2001
Network software S-CNET02 ->DRI Level = 2001 or 2002(WLAN)
Network software L-NET03 ->DRI Level = 2003

Virtual Plug ID indicates the monitor's location (Network ID). Virtual Plug ID is automatically defined when downloading the WLAN option to the monitor.

```
Network    │    Subnet 4 status
    Network Config
                              Tx        Rx
                               0         0
                               0         0
     DRI Level │ 2003          0         0
  Virtual Plug ID  21          0         0
                               0         0
    Previous Menu              0         0
                               0         0
                               0         0
                               0         0
                               0         0
                               0         0
                               0         0
                               0         0
                               0         0
                               0         0


  Select the network comm.
  interface level.
```

1.2.3 Ethernet

The **Ethernet Status** view shows the general status of the ethernet network communication.

Driver: Ethernet chip name (DP83902, DP83907)

Cable: Indicates if the ethernet cable is connected.

EthernetAddr: Monitor's ethernet address.

Speed: Indicates the current ethernet communication speed.

The service data related to the ethernet status view is described in the following table.

```
Ethernet         Ethernet Status

Ethernet Status   Driver          DP83907
Previous Menu     Cable           Connected

                  EthernetAddr    00:40:97:07:1D:16

                  Speed (bits/s)  10000000

                  Statistics           In       Out
                  Packets            1062      2599
                  Bytes            153812   1165085

                  Data errors
                  CRC       Frame      Transm.
                   0          0           0

                  Hardware errors
                  Intern. Missed   FIFO    Overrun
                   0       0        0        0
```

Table 1   **Ethernet service data**

Value	Usage	Notes
Received packets (Statistics In/Packets)	Total number of received packets since last cold start.	
Transmitted packets (Statistics Out/Packets)	Total number of transmitted packets since last cold start.	
Received bytes (Statistics In/Bytes)	Total number of received bytes since last cold start.	
Transmitted bytes (Statistics In/Bytes)	Total number of transmitted bytes since last cold start.	
CRC errors (CRC)	Number of received packets with incorrect checksum.	
Frame errors (Frame)	Number of received packets with incorrect frame structure.	Refers to physical layer problems. An erroneous packet often has both frame and CRC error.
Transmission errors (Transm.)	Number or errors in packet Transmission.	
Internal errors (Intern.)	Internal error of the network board.	Must always be 0.
Missed packets (Missed)	Number of received packets lost due to overload.	Must always be 0.
FIFO errors (FIFO)	Internal error of the network board.	Must always be 0.
Overrun errors (Overrun)	Practically same as above.	Must always be 0.

1.2.4 WLAN

Driver: WLAN driver chip name.

Connection indicates the state of the WLAN connection.

Ethernet Addr: Ethernet address of the WLAN card used.

AP MAC: Ethernet address of the access point where the monitor is currently connected.

Signal Quality indicates the quality of the radio signal between the monitor and the access point (0...100%).

Channel is the WLAN channel configured to the access point where the monitor is currently connected.

Speed indicates the current communication speed with the access point.

RoamCounter Occurred roamings between access points.

Reset Counter *

Network ID: Identifies the WLAN network used.

Firmware version: *

Firmware date: *

Statistics (Packets, Bytes, Errors, Fails, Buffer) shows the WLAN communication related statistics.

 * WLAN PCMCIA card related information

```
WLAN                   WLAN Status

WLAN Status        Driver          Spectrum24
AP List            Connection      Active
WLAN Config  ▤     EthernetAddr    00:A0:F8:3B:87:94
Record Status      AP MAC          00:A0:F8:9D:A1:AB
                   Signal Quality  51%
Previous Menu      Channel         1
                   Speed (bits/s)  11000000
                   RoamCounter     1
                   Reset Counter   0
                   Network ID      DATEXMON
                   Firmware Version V2.50-13
                   Firmware Date   09/27/2001
                   Statistics      Rx        Tx
                   Packets         7140      6105
                   Bytes           656477    425528
                   Errors          0         0
                   Fails                     0
                   Buffer                    0%
```

AP List

Access Points: shows the access points (max. eight) which are visible for the monitor.

CH is the WLAN channel configured to this particular access point.

NL indicates the noise level of the channel used (0...100%)

SL indicates the signal level of the channel used (0...100%)

```
WLAN                AP List

WLAN Status      Access Points      CH   NL   SL
AP List
WLAN Config   ▣  00:A0:F8:9D:A1:AB   1    0   100
Record Status    Not available       0    0    0
                 Not available       0    0    0
Previous Menu    Not available       0    0    0
                 Not available       0    0    0
                 Not available       0    0    0
                 Not available       0    0    0
                 Not available       0    0    0
```

WLAN Config

Network ID is for setting the correct WLAN network ID name.

WEP Algorithm is for setting the level of the encryption (width of encryption key) used for WLAN security (40 bit or 128 bit).

Key ID is for choosing the encryption key used.

Encryption key is for setting the encryption key.

NOTE: When selecting 40 bit encryption, enter 10 Hex digit characters (divided into 2 fields).

When selecting 128 bit encryption, enter 26 Hex digit characters (divided into 2 fields).

NOTE: Use only hexadecimal characters.

NOTE: For all the monitors and access points in the same WLAN network, the previous parameters must be set to be the same.

```
WLAN              AP List

      WLAN Config           CH   NL   SL

                             1    0    0
   Network ID    DATEXMON    0    0    0
  WEP Algorithm  40 Bit      0    0    0
        Key ID   2           0    0    0
Encryption Key   **********  0    0    0
Encryption Key               0    0    0
Encryption Key               0    0    0
Save Configuration          0    0    0
   Previous Menu
```

1.3   MemCards

1.3.1   Status

Module **Present** indicates whether the MemCard option is installed into the monitor. Possible values are YES and NO.

Module **Active** indicates whether the MemCard services are available. Possible values are YES and NO.

ROM indicates the status of the ROM memory of the module. Possible values are OK and ERR.

RAM indicates the status of the RAM memory of the module. Possible values are OK and ERR.

PCMCIA indicates the status of the PCMCIA controller of the module. Possible values are OK and ERR.

EEPROM indicates the status of the EEPROM memory of the module. Possible values are OK and ERR.

```
 MemCards              Status

 Status        Present       YES
               Active        YES
 Communication
               ROM           OK
 Previous Menu RAM           OK
               PCMCIA        OK
               EEPROM        OK

                             SLOT1      SLOT2

               Card type     ---        DATA
               File system   ---        ATA

               Card size     ---        7086 kB
               Card used     ---        6079 kB

               Card full     ---        NO
               Card empty    ---        NO

               Read error    ---        NO
               Write error   ---        NO
```

SLOT1 and **SLOT2** indicate the left hand slot and the right hand slot, respectively.

Card type	indicates whether the card is MENU or DATA card. If a duplicated card is inserted, type DUPL.
File system	indicates the type of the memory card in use. The only supported file system is ATA. If a memory card using another file system is used, the message 'UNKNOWN' is shown. If the card is poorly attached, the message 'LOOSE' is shown.
Card size	indicates the total amount of disk space in the card in kilobytes.
Card used	indicates the total amount of used disk space in the card in kilobytes.
Card full	indicates whether all the disk space in the card is used. Possible values are YES and NO.
Card empty	indicates the lack of menu files in the MENU card or no files in the DATA card. Possible values are YES and NO.
Read error	indicates whether the reading from the card has failed. Possible values are YES and NO.
Write error	indicates whether the writing to the card has failed. Possible values are YES and NO.

All values can be '- - -' to indicate 'No data available'.

1.3.2 Communication

Interface status indicates the status of the data link between the CPU and MEM sections. If the MemCard option is installed, the status should always be on ACTIVE. If the status blinks between ACTIVE and CLOSED, a communications error has occurred.

Message types indicates the type of data packets that have been sent (**Tx**) and received (**Rx**) since last monitor start. Data types are listed on the lines below **Message types** text.

```
┌─────────────┬──────────────────────────────┐
│ MemCards    │        Communication         │
│             │                              │
│ Status      │  Interface status   ACTIVE   │
│             │                              │
│ Communication│  Message types    Tx    Rx  │
│             │  Record K          0      0  │
│ Previous Menu│  File Op.          0      0  │
│             │  Service           0      0  │
│             │  Modes             0      0  │
│             │  Module status   428    423  │
│             │  Packets total   428    423  │
│             │  Bytes total   30866  41922  │
│             │                              │
│             │                              │
│             │                              │
│             │  Timeouts     0              │
│             │  Chksum err   0              │
│             │  Length err   0              │
│             │  Duplicated   0              │
└─────────────┴──────────────────────────────┘
```

Data types:

Record K	indicates the communication between the Monitor and Record Keeper.
File Operation	indicates the operations of Patient data.
Service	indicates the MEM section operations.
Modes	indicates the User Mode operations.
Module status	indicates the number of sent/received data packets that relate to the MEM section status.
Packets total	indicates the total amount of data packets that have been sent/received since the last monitor start.
Bytes total	indicates the total amount of data bytes that have been sent/received since the last monitor start.

The last four lines indicate transmission errors:

Timeouts	indicates the number of timeouts that have occurred in MEM section data transmission since the last monitor start.
Chksum err	indicates the number of checksum errors in data packets from MEM section since the last monitor start.
Length err	indicates the number of data packets with erroneous length from the MEM section since the last monitor start.
Duplicated	indicates the number of duplicate data packets from the MEM section since the last monitor start.

1.4   Power supply

The menu shows the voltages and the temperature measured by the power management board (PMB Voltages) and the main CPU board in the Display unit(DU Voltages). The measurement starts about 100 ms after a start-up. The values in the column under **Mean** are the mean values of the last one second, the **Min** column shows the minimum mean value, and the **Max** column the maximum mean value of the voltages and temperature measured during the current power ON.

The following voltages are measured by the PMB in the Frame Unit:

Raw DC

+15V	14.65....15.35
–15V	-14.65...-15.35 V
+15VD	14.65...16.00 V
+5V	4.85...5.25 V

```
Power Supply  |      Service Data

Battery      ▤  | PMB Voltages  Min     Mean    Max
                | +15V          15.05   15.05   15.05
Record Data     | -15V         -14.89  -14.89  -14.89
                | +15VD         14.82   14.84   14.86
Previous Menu   | +5V            4.90    4.90    4.90
                | VBUS          15.21   15.23   15.29
                |
                | Temp (°C)     34.29   34.29   34.29
                |               Clk     Check   Reset / cnt
                | Status        12099   0       0       0
                |
                |
                | DU Voltages   Min     Mean    Max
                | +12V          11.63   11.90   11.98
                | +3.3V          3.21    3.29    3.32
                | VBUS          14.94   15.23   15.31
                |
                | Temp (°C)     47.54   47.84   48.52
                |
                | MPS status                     0
                | MPS input current(A)           0.85
                | AC/DC capacity in use (%)      18.1
                | AC/DC Voltage                 15.21
```

Temp (°C) value corresponds with the Frame Unit internal temperature measured by the PMB.

The numbers on this page are only directive and not absolute values.

The following voltages are measured by the Central Processing Board in the Display Unit:

+12V	11.50...12.50V
+3.3V	3.00...3.60V
VBUS	10.00...17.00V

Temp (°C) value corresponds with the Display Unit internal temperature measured by the Central Processing Board.

MPS input current is the current fed to the Module Power Supply. The current should be <4A.

AC/DC capacity in use is the capacity information achieved from the AC/DC unit by the PMB.

AC/DC voltage is the AC/DC power unit output voltage measured by the PMB.

1.4.1   Battery

Select Battery: Selection of battery type.

Capacity: Selection of battery capacity.

Previous Menu: Return to the previous menu.

Service Data

Type shows the type of the battery used.

Capacity refers to battery capacity in Ah.

Left [%]: Evaluated capacity left in battery.

Temperature [°C] measured inside the battery.

Current [A] shows the charging state and charging current.

Voltage [V] (Full, Timed, Fast) shows the measured battery voltage.

Monitor Temperature shows the Frame Unit inside temperature measured by the PMB.

```
Battery              Service Data

Select Battery                  Batt 1      Batt 2

-Capacity         Type            NiMH        NiMH
                  Capacity  (Ah)  4.000       4.000
Previous Menu     Left      (%)     100         100
                  Temperature (C)  29.26       29.29


                   Change date


                  Current  (A)      0.00        0.00
                                 Full        Full
                  Voltage  (V)     14.35       14.27


                  Monitor Temperature (C)      29.11
```

1.5   PCMCIA Board

Chip type is the type of the PCMCIA controller chip used.

Number of slots is the number of PCMCIA card slots in use (0, 1 or 2).

Slot A/B State and **Drv Active** indicate if the PCMCIA card slot is active.

Driver Ptr, Detect Int and **PcCard Int**: PCMCIA card driver software related data.

PcCard info: General PCMCIA card related information.

```
PCMCIA Board        PCMCIA Status

PCMCIA Status     Chip Type     CL-PD6722
                  Number of slots  2
Previous Menu
                  Slot A State  Closed or no card
                  Driver Ptr    0x00000000
                  Drv Active    -
                  Detect Int.   0
                  PcCard Int.   0
                  PCCard Info   Not available


                  Slot B State  Closed or no card
                  Driver Ptr    0x00000000
                  Drv Active    -
                  Detect Int.   0
                  PcCard Int.   0
                  PCCard Info   Not available
```

2   Display

Geometry views the geometry of the display.

Colors views the color of the screen.

Readability views the readability of the screen.

```
┌──────────────┬──────────────────────────┐
│ Service Menu │   Sw version / Unit id    │
├──────────────┴──────────┐               │
│         Display          │               │
│                          │ ---------------│
│      Geometry │          │ )11845-1.0    │
│       Colors             │               │
│      Readability         │ ---------------│
│      Previous Menu       │ )04-03-12     │
│                          │ ---------------│
│                          │ e: level: ------│
│                          │ 01            │
│                          │ ---------------│
│                          │               │
│                          │ ---------------│
│                          │ ?, 2004-03-15 │
│                          │ number: ------- │
│      View geometry.      │ )de not set, 200│
│                          │ ---------------│
│                          │        -More- │
└──────────────────────────┘               │
```

3   Keyboard

Keyboard

The service menu for testing the command board functions.

Upper Led is for testing the upper alarm LED (red) on the command board. When the text is highlighted, the upper alarm LED can be turned on and off by pressing the ComWheel.

Lower Led is for testing the lower alarm LED (yellow) on the command board. When the text is highlighted, the lower alarm LED can be turned on and off by pressing the ComWheel.

Dummy Press is for testing the ComWheel. When the text is highlighted, pressing the ComWheel creates a sound from the loudspeaker and the corresponding number on the service data field increases.

```
Keyboard            Service Data
                  Message count     1
Upper Led         Leds upper   OFF  lower      OFF

Lower Led         Direct action keys

Dummy Press       Silence   Freeze    Mark      Alarms
                  Alarms              Event     Setup
Keyboard Log  ▣
                  Recorder  ECG       NIBP      Invasive
Keyboard Type ▣                                 Pressures

Previous Menu     Normal
                  Screen

                  Help      Reset     Display   Monitor
                            Case      Trends    Setup

                  Patient   Pulse     Airway    Others
                  Data      Oximetry  Gas


                  Control wheel
                  Press        0
                  Clockwise    0  Counterclockwise    0
```

Service Data

Message count counts the number of messages that are sent out to the main CPU board.

Leds upper and **lower** indicate the states of the alarm LEDs on the command board.

Direct action keys texts are indications to the command board membrane keys. When a key on the command board is pressed, the corresponding text in the menu changes its colour.

Control wheel, **Press** counts the ComWheel pressings.

Control wheel, Clockwise and **Counter clockwise** indicate the ComWheel turnings.

Since shows the date and the time of the last run time reset.

3.1   Keyboard Log

Keyboard Scroll Log

All the keyboard presses and the commands given by the ComWheel are recorded in the Keyboard Log. The keyboard log is saved in the permanent memory of the monitor. The length of the log is 1150 events. The log is FIFO type.

Scroll Stat enables to scroll the keyboard events.

```
Keyboard              Keyboard Log

Scroll Log      ◄
Scroll Stat              ▲Keyboard        : Keyboard Log
                                          2004-Jan-29 05:40:54
Record Log                 Service Menu    : Keyboard
Record Stat                               2004-Jan-29 05:40:40
                           Display         : Previous Menu
Reset log                                 2004-Jan-29 05:40:39
                           Service Menu    : Display
Previous Menu                             2004-Jan-29 05:40:11
                           Frame           : Previous Menu
                                          2004-Jan-29 05:40:09
                           Network         : Previous Menu
                                          2004-Jan-29 05:40:05
                           WLAN            : Previous Menu
                                          2004-Jan-29 05:40:00
                           WLAN Config     : Previous Menu
                                          2004-Jan-29 05:39:57
                         ▼WLAN             : WLAN Config
                                                     -More-
```

3.2   Keyboard Type

Store Mask A selection for the anaesthesia keyboard's language. The selected language determines the outcome of the lower keypad.

Store Type is for selecting the keyboard;

COM = Command Board

ARK = Anaesthesia Keyboard

AIC = Information Center Keyboard

NOTE: The settings should be checked if the controller board is replaced. If settings are changed, the new settings will not be valid until the next start-up.

```
Keyboard            Service Data

     Keyboard Type            r      OFF

        Store Mask │ None
                                  rk     Alarms
        Store Type   None        ent    Setup

        Previous Menu           BP     Invasive
                                        Pressures


                                 splay  Monitor
                                 ends   Setup

                                 rway   Others
                                 s


        Select keyboard mask.   terclockwise    1
```

4   Parameters

NOTE: Parameter values in Service Data fields are only for reference in this section.

```
┌─────────────┬──────────────────────────┐
│Service Menu│ Sw version / Unit id    │
│  ┌────────────────────────┐           │
│  │    Parameters          │ ──────────────│
│  │                        │           │
│  │  Gas Unit   ▣          │ L005168-16.0│
│  │  ESTP : ECG ▣          │ ──────────────│
│  │  ESTP : STP ▣          │           │
│  │       P/PT  ▣          │ L-05-24    │
│  │         PP  ▣          │ ──────────────│
│  │        COP  ▣          │ e: level: ───────│
│  │       NIBP  ▣          │ )         │
│  │        NMT  ▣          │ ──────────────│
│  │       M-SAT ▣          │           │
│  │      More... ▣         │ ──────────────│
│  │  Previous Menu         │           │
│  │                        │ ──────────────│
│  │                        │      -More-│
└──┴────────────────────────┴───────────┘
```

4.1   Gas Unit

Service menu for airway gas modules' communication and airway gas and spirometry measurements.

```
┌──────────────────────────┐
│      Parameters          │
│  ┌────────────────────┐  │
│  │     Gas Unit       │  │
│  │                    │  │
│  │   General   ▣      │  │
│  │     Gases   ▣      │  │
│  │  Spirometry ▣      │  │
│  │  Previous Menu     │  │
│  │                    │  │
│  │                    │  │
│  │                    │  │
│  │                    │  │
│  │                    │  │
│  │                    │  │
│  │                    │  │
│  └────────────────────┘  │
└──────────────────────────┘
```

4.1.1 General

Service Data

Module configuration shows which measurement options are available, i.e. are detected by the module.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

```
 General              Service Data

Previous Menu   Module configuration

                CO2  O2   N2O  AA   id   p&V   GasExch.
                 0    0    0    0    0    0     0




                       0 = not available
                       1 = available










                Timeouts     -12867
                Bad checksums      0
                Bad c-s by mod     0
```

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

4.1.2 Gases

Noise Meas   activates the noise measurement.

Sample gain adj adjusts the sampling pump gain, i.e. for adjusting the sample flow measurement.

Fall time Meas * activates the fall time measurement.

Pump ctrl   A manual control for the sampling pump.

Zero valve ctrl   A manual control for the zero valve.

Occl valve ctrl* A manual control for the occlusion valve.

Record Data   prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.

```
┌──────────────┬────────────────────────────────────┐
│   Gases      │        Service Data                │
│              │             ON                     │
│ Noise Meas   │       %    noise-%    mV      Gain  │
│              │  O2  55.19  0.08     1270    0.908  │
│ Sample gain adj│CO2  4.96   0.01     1702    0.986  │
│              │  N2O 33.34  0.09      970    1.018  │
│ Fall time Meas│ AA1  1.97   0.00  A  1916    0.995  │
│              │  AA2   ---        B  1459          │
│ Pump ctrl    │  ID    Des        C  1553          │
│              │  ID unrel.   36   D  1553          │
│ Zero valve ctrl│                  E  2529          │
│              │ ───────────────────────────────── │
│ Occl valve ctrl│Sample Flow  200.6  Zero  -3.7 ml/min│
│              │      Gain   1.000                  │
│ Record Data  │ Ambient      747  Amb-Work 45 mmHg │
│              │                                    │
│ Previous Menu│ OFF   Fall time CO2  --- O2 --- ms │
│              │       CO2-O2 Delay  641       ms   │
│              │ ───────────────────────────────── │
│              │ Pump   ON  19.47 % 5003   mV       │
│              │ Lamp   ON  46.40 % 1050   mA       │
│              │ Fan    ON                          │
│              │ Zero valve  MEAS  Occl valve MEAS  │
│              │ Temp  TPX  37.6 CPU  32.9OM  30.1C │
│              │ Time after power on     103min     │
└──────────────┴────────────────────────────────────┘
```

Service Data

O$_2$, CO$_2$, N$_2$O, AA

    % field shows real-time concentrations.
    noise-% is standard deviation of concentration.

O$_2$, CO$_2$, N$_2$O, AA channels A-E

    mV field: signal is scaled to mV.
    Gain: User gain. It is scaled as (User gain)/(Factory gain).

ID*   Shows the identified agent.

ID unrel.*   The shown value tells how unreliable the identification is. With pure agent the value is typically < 75.

Sample Flow   is calculated from differential pressure and adjusted by the module. **Zero** value as measured during initialization when the pump is off. **Gain**: sample flow measurement can be calibrated by adjusting the gain.

Ambient*   Ambient pressure is measured continuously in E-miniC. In M-miniC it is measured at least once an hour (during the first running hour during each zeroing process). In M-Gas it is measured once an hour .

Amb-Work: ambient pressure - sampling system internal pressure.

Fall time*   CO$_2$ and O$_2$ in ms. For N$_2$O and AA same as CO$_2$.

CO$_2$-O$_2$ Delay*   In ms. No delay between CO$_2$, N$_2$O, and agents.

Pump   Can be toggled ON/OFF. PWM output 0-100% is shown. Pump voltage is also shown.

Lamp   The state, PWM control, and current of the lamp are shown.

Fan*   The state of the fan is shown.

Zero and Occl valve Can be toggled between the measurement state (MEAS) and zeroing/occlusion states (ZERO/OCCL).

Temp   Temperatures measured by the module from TPX, CPU, and OM.

Time after power on In minutes after power on.

4.1.3 Spirometry

Insp and exp flow gains can be adjusted, if calibration is needed. A calibration pump or spirometry tester is used and readings are observed from the display. If a deviation exists, gains are adjusted accordingly. Gain scaling is 1.000, when the factory settings are in effect (1.050 in modules that contain the Gas Exchange measurement).

When the Adjust key is pressed, a separate box for adjusting the value appears. During adjustment calibration, values are sent to the module. When the ComWheel is pressed, the values are permanently stored in EEPROM of the module and the box disappears.

Zero PVX: Start zeroing the pressure sensors. Effects Aw Pres Zero and Flow Zero value.

Exp Flow Gain / Insp Flow Gain: Adjust the Flow sensor gains.

Valves: Switch between MEASUREMENT and ZEROING

VCO2 / VO2 Gain: Adjust the VCO_2 and VO_2 gain.

Y deadspace: Adjust the Y-deadspace.

N2 injection: Select between on (1) and off (0).

Record Data: Record Data prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.

```
Spirometry        Service Data
                      Adult
Sensor Type    Aw Pres Zero          0
               Aw Pres Gain       1138
Zero PVX       Flow Zero             0
               Adult  xp Gain    1000
Exp Flow Gain         nsp Gain   1000
               Common Offset         0
Insp Flow Gain Valves         MEAS
               Zeroing        disabled
Valves
               Aw Pressure(cmH20)   3.1
VCO2 Gain
               Ref. Condition    BTPS
VO2 Gain
               Conv. factor  Exp  0.978
Y deadspace      from ATP   Insp  0.981
               Flow    (l/min)    11.6
N2 injection
               TVol Exp  (ml)      934
Record Data    TVol Insp (ml)      130
               MVol Exp  (l/min)  11.95
Previous Menu  MVol Insp (l/min)   0.71
               VCO2 Gain          1000
               VO2 Gain           1000
               Y deadspace (ml)    5.0
               N2 injection          0

               Ambient press (mmHg) 746
```

Service Data

Sensor ADULT/PEDIATRIC according to the selected measurement mode (sensor).

Insp/Exp Flow Gains shown apply to the selected sensor.

Aw Press Zero and **Flow Zero** are the result of zeroing in the user service menu. They can be adjusted in the factory calibration menu, but not permanently stored.

Aw Press Gain is directly the value used in sw. It can be adjusted, but not permanently stored.

Exp Flow and **Insp Flow Gains** are scaled as (User gain)/(Factory gain). **Exp** and **Insp Flow Gains** can be adjusted also in the user service menu.

Common Offset is the compensation factor for pressure difference reading of the difference sensor when applying an equal pressure on both sides of the sensor.

Valves can be changed between **MEASUREMENT** and **ZEROING**.

Zeroing automatic zeroing either **ENABLED** or **DISABLED** (only factory service menu).

Aw Pressure shows the real time value of airway pressure.

Condition shows in which reference conditions the results are. With calibration pump or spirometry tester, the results are always in ATP. If breathing is detected ($EtCO_2 > 1.0\%$), the results are according to the **Flow & Vol Setup** selection.

Flow shows the flow measurement value.

TVol Exp, TVol Insp, MVol Exp and **MVol Insp** are shown to ease calibration. The numbers are the same as on the main display. The former pump calibration procedure has been dropped out. We claim that calibration is not needed in routine clinical use, so a separate Flow calibration menu is not needed. Calibration can be done with the pump or spirometry tester. The results must be taken from the screen and gains adjusted accordingly.

VCO$_2$ and **VO$_2$ Gain** show a value near 1000, the correct gains have been measured in the factory.

Y deadspace is the geometric volume in ml between the Y-piece and the D-lite. Default is 5 ml for a standard Y-piece (as delivered with Siemens 900C ventilators). Used for VCO_2 and VO_2 delay time corrections.

Set **N$_2$ injection** to 1 during laboratory tests with a Spirometry tester and injection of N_2 gas (for scientific validations use only). At power on of the module, the value is always zero.

Ambient pressure value measured by the module.

4.2   ECG Module

Power freq: Set power frequency; 50 Hz/60 Hz.

Filter low: Set filter low frequency; 0.05 Hz/0.5 Hz.

Filter high: Set filter high frequency; 30 Hz (40 Hz if power freq is 60 Hz) /100 Hz or 150 Hz @ NE12STPR.

Service Data

Power freq, and Cable type show the values chosen or detected, **Filter low and high** defines the selected filter (Monitor/Diagnostic/ST).
Quick zero at PRESTN series module is ON when the ECG signal is beyond the scale, and therefore, is quickly returned to optimal range using fast signal processing methods. All the **Quick zero** bits are ON at the same time.
Cable shows ON when ECG cable is connected.

Electrode shows ON when each of these electrodes are connected.

```
ECG Module          Service Data

ECG Setup  ▣      Power freq      50 Hz
                  Filter    low 0.05 Hz high    30 Hz
Power Freq        Cable type       5 lead
                  Quick zero      ON   ON   ON      .    .
Filter Low        Cable          OFF
                  Electrode       RA   LA   LL   V    RL
Filter High                      OFF  OFF  OFF  OFF  OFF
                                  V2   V3   V4   V5   V6
Previous Menu                    OFF  OFF  OFF  OFF  OFF

                  Pacer count      4

                  Button         OFF


                  Resp
                  Available       ON
                  Measurement     OFF
                  Amp Zero        OFF
                  Value           ---



                  Timeouts         2    RAM     OK
                  Bad checksums    0    ROM     OK
                  Bad c-s by mod   0    EEPROM  OK
```

Pacer count is a running number for pacemaker users.

Button No effect on the module.

Resp Available indicates that ECG hardware is capable of measuring impedance respiration.

Measurement shows ON when the respiration measurement is on.

Amp zero shows ON when zeroing of the respiration amplifier takes place.

Waveform **VALUE** will be updated in one second interval.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.2.1 ECG Setup

Filter filters the ECG signal high frequency noise and slow respiratory artefacts.

Monit (monitor) filter is used in routine monitoring. It effectively filters the artefacts caused by the electrosurgery unit and respiration.

Diagn (diagnostic) filter is used if more accurate information of the waveform is needed (e.g. of P-wave or AV block). The diagnostic filter is more susceptible both to high frequencies and baseline wander than the monitor filter.

STfilt (ST filter) permits more accurate information of ST segment. It filters the high frequency artefacts caused by the electrosurgery unit, but catches the slow changes in ST segment. The ST filter is more susceptible to baseline wander than the monitor filter.

5-lead cable selects five or three electrodes. With the 12-lead ECG the selection is automatic.

```
┌─────────────────┬──────────────────────────┐
│ ECG Module      │      Service Data         │
├─────────────────┴──────────────────────────┤
│      ECG Setup          Hz                   │
│                         Hz high    30 Hz     │
│    Filter   STfilt      lead                 │
│                         OFF OFF              │
│  5-lead Cable  3elect  Monit                 │
│                         LA   LL   V   RL     │
│  ⚠ Pacemaker  Hide    STfilt  ON  ON  OFF  ON │
│                         V3   V4   V5   V6     │
│  Previous Menu         Diagn  OFF OFF OFF OFF │
│                                              │
│              ......                          │
│                                              │
│  Use ST filter for optimal                   │
│  ST analysis.           RAM    OK            │
│                         ROM    OK            │
│                         EEPROM OK            │
└──────────────────────────────────────────────┘
```

Pacemaker selects how to display the pacing pulse of cardiac pacemaker. The selections are **Show, Hide**, **ON R** and **Sensit**.

Hide, the pacing pulse is filtered away from ECG data.

Show, the pacer pulse is filtered away from ECG data but the pulse is displayed as a constant height marker.

ON R, pacing pulses are not filtered away from ECG data. This improves ECG monitoring with A-V pacemaker patients, as QRS complexes are counted even if the pacing pulse hits the QRS complex. However, during asystole the monitor may count pacing pulses as heart beats.

Sensit selection uses a more sensitive pacemaker detection. Pacemaker spike is displayed on ECG.
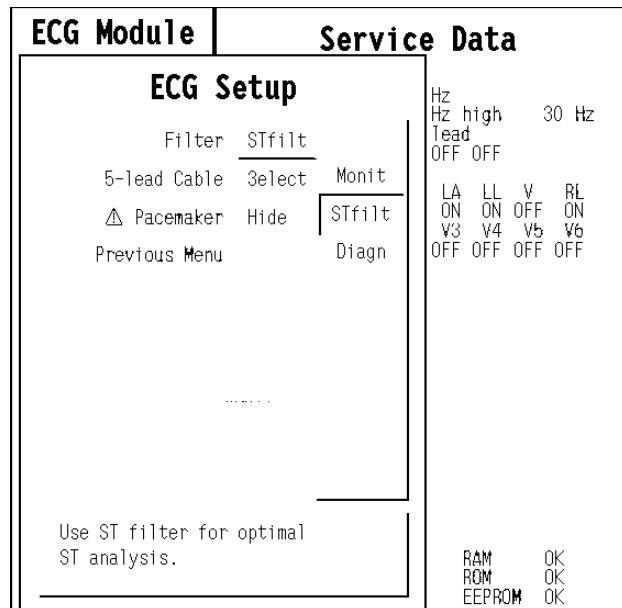
4.3   ESTP Module

Service menu for the multiparameter hemodynamic module's oxygen saturation, temperature and invasive pressure measurements.

NOTE: Pressure Module, M-P or E-P, and Pressure Temperature Module, M-PT or E-PT, have their own service menu; "4.4 P/PT." and so does Dual Pressure Module, M-PP or E-PP; "4.5 PP."

Calibrations opens a submenu for temperature (T1, T2) and pressure (P1, P2) calibrations. See section "Calibrations".

Record Data prints out the shown service data and board information (id, serial number and sw id) onto the recorder module.

Temp Test activates the automatic temperature test for the temperature channels T1 and T2. The result from the test is shown in the service data field.

NOTE: The Temp Test needs to be selected twice before the test starts.

```
ESTP Module        Service Data
                       P1     P2     T1     T2
Calibrations  ▣  Gain  22575  22652  15185  15196
                 Zero      6     -3     34     33
Record Data      Cable    ON     ON    OFF    OFF
                 Probe   OFF    OFF    OFF    OFF
Temp test        Value   ---    ---    ---    ---

Previous Menu    Buttons  OFF    OFF    OFF

                 SpO2     ---    Ired int.    220
                 Modpr    ---    Red int.     220
                 Hr       ---    DC gain      140
                 Cable     ON    IDC         2042
                 Probe     ON    RDC         2047
                 Probe off        AC gain       0
                                  Pre gain      0

                 Temp error          OFF    OFF

                 Temp test   OFF

                 Protect key    OFF
                 Protect mode    ON
                 Configuration  STP

                 Timeouts        2    RAM    OK
                 Bad checksums   0    ROM    OK
                 Bad c-s by mod  0    EEPROM OK
```

Service Data

Gain is a coefficient to compensate gain error. Usually the values for P1 and P2 are between 17000 and 25000 and for T1 and T2 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P1 and P2 are within ±1000 and for T1 and T2 between -150 and +300. Calibrate if zero and/or gain value is outside the ranges.

Cable shows ON when a corresponding cable is connected to the front panel and **Probe** shows ON when a corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. Pressure values are real time values and shown in mmHg. Temperature values are shown in degrees Celsius.

The front panel STP keys functions are confirmed by pressing each key and observing that OFF turns to ON at **Button**.

SpO$_2$ shows the measured beat-to-beat SpO$_2$ value.

Modpr is a modulation % that indicates the AC/DC ratio in the measured signal.

Hr is a pulse rate calculated from every beat.

Cable and **Probe** can be either OFF or ON, and these indicate the state PROBE OFF.

Under them there is a **message field for SpO$_2$**. It can be OK, PULSE SEARCH, NO PROBE, PROBE OFF, NO PULSE, ARTEFACT, POOR SIGNAL, or CHECK PROBE.

Balance between leds is adjusted by changing the intensity of red/infrared. Intensity of infrared (**Ired int.**) is in the range of 40 to 255 and red intensity (**red int.**) is in the range of 40 to 255.

DC gain shows the gain of DC signal adjusted by the module.

IDC is the value of infrared signal.

RDC is the dc value of red signal.

AC gain is the gain of infrared and red ac signals. AC gain values can be 1 or 0. Value 1 means high ac gain and 0 means low gain.

Pre gain is a preamplifier gain for infrared and red signals. Pre gain values can be 1 or 0. Value 1 means normal operation. Value 0 means that signal levels are very low and extra gain is taken into use.

Temp error shows the status of the temperature test. No errors found show the status (OFF) and errors found (ON).

Protect key shows normally OFF, but turns to ON when the button at the bottom of the module is pressed.

Protect mode is normally ON. It turns to OFF, when Protect is switched to OFF for the temperature calibration in Calibration Menu.

Configuration shows the chosen module configuration: TP, ST, or STP.

Timeouts is a cumulative number that indicates how many times the module has not responded to the the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.

EEPROM indicates if the values stored in the permanent memory are valid.

The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.3.1   Calibrations

Protection: Protection for the configuration and temperature calibrations can be set ON and OFF.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are TP, ST or STP. The configuration setting should be checked, if the STP board is replaced.

Calibrate T1 / Calibrate T2: The functions are for calibrating the temperature channels T1 and T2.

Calibrate P1/ Calibrate P2: The functions are for calibrating the invasive blood pressure channels P1 and P2.

```
ESTP Module |          Service Data
       |                     T1      T2
     Calibrations        5185   15196
                             34      33
     Protection    ON        ON      ON
                             ON      ON
     Set Config   STP     6.74  37.05

     Calibrate T1           OFF

     Calibrate T2        int.      220
                         int.      220
     Calibrate P1|       ain       110
                                  2047
     Calibrate P2                 2047
                        ain         0
     Previous Menu      gain        1

                          OFF    OFF


   Calibrate transducer with
   manometer. Push ComWheel to   2  RAM     OK
   start zeroing.                0  ROM     OK
                                 0  EEPROM  OK
```

How to calibrate T1/ T2

The calibrations are possible only when the protection is set *OFF*. The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

1.   Select **Calibrate T1/Calibrate T2.**

2.   Insert the test plug 25 °C into the T1/T2 connector.

3.   Press the ComWheel.

4.   Insert the test plug 45 °C into the T1/T2 connector.

5.   Press the ComWheel.

How to calibrate P1/ P2

The calibrations require a pressure transducer (with appropriate cable) and a pressure manometer.

1.   Connect the pressure transducer with the pressure manometer to the P1/P2 connector. Select **Calibrate P1/Calibrate P2**. Leave the transducer to room air pressure.

2.   Press the ComWheel to start zeroing.

3.   Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.

4.   Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.4   P/PT

Service menu for Pressure Module, M-P or E-P, and Pressure Temperature Module, M-PT or E-PT.

Calibrations: see section "P/PT Calibrations".

Temp Test activates the automatic temperature test for the temperature channels T3 and T4. The result from the test is shown in the service data field.

NOTE: The Temp Test needs to be selected twice before the test starts.

Record Data: Record Data prints out the shown service data and board information (id., serial number, and software id.) onto the recorder.

Service Data

Gain is a coefficient to compensate gain error. Usually the value for P3 is between 17000 and 25000 and for T3 and T4 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P3 are within ±1000 and for T3 and T4 between -150 and +300. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable isconnected to the front panel.

Probe shows ON when the corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. The pressure value is a real time value and shown in mmHg.

Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Temp error shows whether the calibration of the temperature was successful or not.

Protect key shows normally OFF but turns to ON when the button at the bottom of the module is pressed.

Protect mode is normally ON. It turns to OFF when Protect is switched to OFF for the temperature calibration in Calibration Menu.

Configuration shows the chosen module configuration: BP or PT.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is also a cumulative number that indicates how many times communication from the module to monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

```
P/PT                 Service Data
                              P3      T3     T4
Calibrations  ▣     Gain    20877   13773  13707
                    Zero       -1     106    104
Temp test           Cable      ON     OFF    OFF
                    Probe      ON     OFF    OFF
Record Data         Value  114.96     ---    ---

Previous Menu       Button    OFF

                    Temp error         OFF    OFF




                    Temp test          OFF

                    Protect key    OFF
                    Protect mode    ON
                    Configuration   PI

                    Timeouts        5   RAM     OK
                    Bad checksums   0   ROM     OK
                    Bad c-s by mod  0   EEPROM  OK
```

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.4.1   P/PT Calibrations

Protection for the configuration and temperature calibrations can be set ON and OFF only when the protect button at the bottom of the module is pressed.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are BP or PT.

The configuration setting should be checked, if the PT board is replaced.

Calibrate T3 and Calibrate T4: The functions are for calibrating the temperature channels T3 and T4.

Calibrate P3: The function is for calibrating the invasive blood pressure channel P3.

```
┌──────────────────────────────────────────────┐
│ P/PT        │       Service Data              │
│ ┌──────────────────────────────┐ T3    T4     │
│ │   Calibrations               │ 3773  13707  │
│ │                              │ 106   104    │
│ │   Protection   OFF           │ ON    ON     │
│ │                              │ ON    ON     │
│ │   Set Config   PT    ┌BP     │ ---   ---    │
│ │   Calibrate T3       │ PT    │              │
│ │   Calibrate T4       │       │ ON    ON     │
│ │   Calibrate P3       │       │              │
│ │   Previous Menu      │       │              │
│ │                      │       │ ON           │
│ │                      │       │              │
│ │                      │       │              │
│ │              2  RAM    OK    │              │
│ │              0  ROM    OK    │              │
│ │              0  EEPROM OK    │              │
└──────────────────────────────────────────────┘
```

How to calibrate T3/ T4

The calibrations are possible only when the protection is set **OFF.** The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

1. Select **Calibrate T3 / Calibrate T4.**
2. Insert the test plug 25 °C into the T3 / T4 connector.
3. Press the ComWheel.
4. Insert the test plug 45 °C into the T3 / T4 connector.
5. Press the ComWheel.

How to calibrate P3

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P3 connector. Select **Calibrate P3**. Leave the transducer to room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.5   PP

Service menu for Dual Invasive Pressure Module, M-PP or E-PP.

Calibrations: see section ”PP Calibrations.”

Record Data prints out the service data and circuit board information (id., serial number, and software id.) on the recorder.

Service Data

Gain is a coefficient to compensate for gain error. Usually the values for P5 and P6 are between 17000 and 25000.

Zero indicates the offset compensation value for each parameter in the A/D converter. Typically the values for P5 and P6 are within ±1000. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

```
 PP                Service Data
                         P5      P6
 Calibrations  ▣   Gain  22419   22389
                   Zero     74     -80
 Record Data       Cable    ON      ON
                   Probe    ON      ON
 Previous Menu     Value  -3.96   0.04

                   Button   OFF     OFF




                   Timeouts         2   RAM    OK
                   Bad checksums    0   ROM    OK
                   Bad c-s by mod   0   EEPROM OK
```

Value displays the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum in the EPROM is in accordance with the software calculated value.

EEPROM indicates whether the values stored in the permanent memory are valid. The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.5.1 PP Calibrations

Calibrate P5 and Calibrate P6
These functions are for calibrating the invasive blood pressure channels P5 and P6.

```
  PP              Service Data
 ┌─────────────────────────┐P6
 │     Calibrations        │9
 │                         │0
 │   Calibrate P5│         │N
 │   Calibrate P6          │N
 │   Previous Menu         │4
 │                         │F
 │
 │
 │
 │
 │  Calibrate transducer with
 │  manometer. Push ComWheel to  2  RAM    OK
 │  start zeroing.               0  ROM    OK
 └─────────────────────────     0  EEPROM OK
```
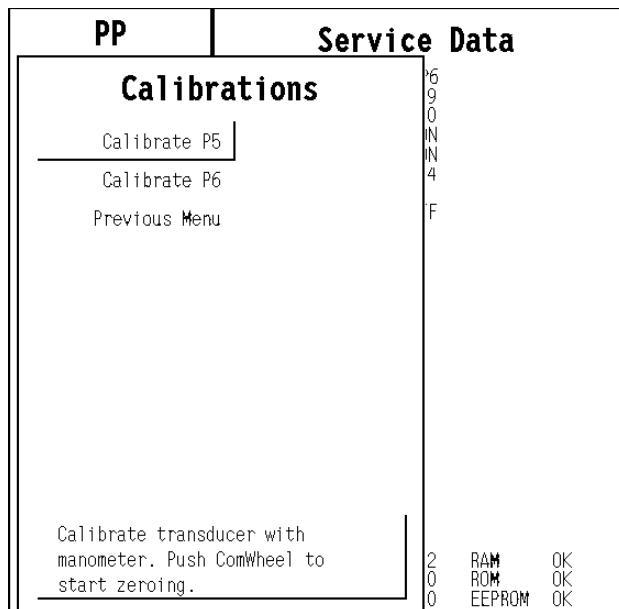
How to calibrate

The calibrations require a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P5 / P6 connector. Select Calibrate P5 / Calibrate P6. Leave the transducer at room air pressure.

2. Push the ComWheel to start zeroing.

3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.

4. Set the pressure on the display to match the pressure reading on the manometer and push the ComWheel.

4.6   COP

Service menu for Cardiac Output Module, M-COP or E-COP, and Cardiac Output and Mixed Venous Oxygen saturation (SvO2) Module, M-COPSv or E-COPSv.

Record Data prints out the service data and module information (id. serial number and software id.) on the recorder.

Service Data

P4

Gain is a coefficient to compensate for gain error. Typically the value is between 17000 and 25000. Calibrate if the zero and/or gain value is outside the ranges.

Zero indicates the offset compensation value of each parameter in the A/D converter. Usually the value is within ±1000.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

```
 COP                     Service Data
                            P4
Calibrations  ▣   Gain    20801
                  Zero       -2         C.O.
Record Data       Cable     ON     Catheter   Inj.
                  Probe     ON        ON        FT
Previous Menu     Value   122.30     36.87     -5.77


                            SvO2

                  Meas. state  No OM    OM fail    OK
                  Value         ---     OM temp.   OK
                  Gain           0      Pulse SQI  0/0
                  Red int        0      Clipp. SQI 0
                  IRed int       0      Int. SQI   0/0
                  Loc red        0
                  Loc ired       0


                             P4      C.O.
                  Button     OFF      OFF



                  Timeouts           2    RAM     OK
                  Bad checksums      0    ROM     OK
                  Bad c-s by mod     0    EEPROM  OK
```

Value shows the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

Probe items **Catheter** (ON/OFF) and **Inj.** (FT, BATH, or OFF) indicate connections and **Value** indicates the measured temperatures in 0.01 °C increments.

SvO2

Meas. state: Measurement status shows: No optical module (No OM) connected, initializing the optical module (Init OM), normal measurement state (Normal) and failed module (OM fail).

Value is a measured SvO_2 value.

Gain is the gain of the remote red and infrared signals (0, 1, 2 or 3)

Red int: Reflected red intensity

Ired int: Reflected infrared intensity

Loc red: Local red intensity

Loc ired: Local infrared intensity

OM fail: Reason why initialization OK (OK), cannot read EEPROM of the optical module correctly (EEPROM), cannot adjust LED current to get required local signal (Transmit).

OM temp: Temperature of the optical module OK (OK), temp under 43 °C (Under), temp over 47 °C (Over).

Pulse SQI: Signal quality index for pulsing (low pulse/high pulse). 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Clipp. SQI: Signal quality index for wall artifact. 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Int. SQI: Signal quality index for intensity shift from previous calibration or Hgb update (intensity decreased/increased) 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Button: The front panel Zero P4 and Start C.O. key functions can be confirmed by pressing the key and checking that the relevant OFF message turns to ON.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the external RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the software calculated value.

EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.6.1 COP Calibrations

Calibrate P4

This function is for calibrating the invasive blood pressure channel P4.

```
 COP          │    Service Data
┌────────────────────────┐
│    Calibrations        │
│                        │  C.O.
│  ┌──────────────┐      │ eter   Inj.
│  │ Calibrate P4 │      │        FT
│  └──────────────┘      │ 8    -5./7
│    Previous Menu       │
│                        │
│                        │ OM fail   OK
│                        │ OM temp.  OK
│                        │ Pulse SQI 0/0
│                        │ Clipp. SQI 0
│                        │ Int. SQI  0/0
│                        │
│                        │
│                        │ C.O.
│                        │ FF
│      ─────             │
│  Calibrate transducer with │
│  manometer. Push ComWheel to │ 2  RAM   OK
│  start zeroing.        │ 0  ROM   OK
└────────────────────────┘ 0  EEPROM OK
```
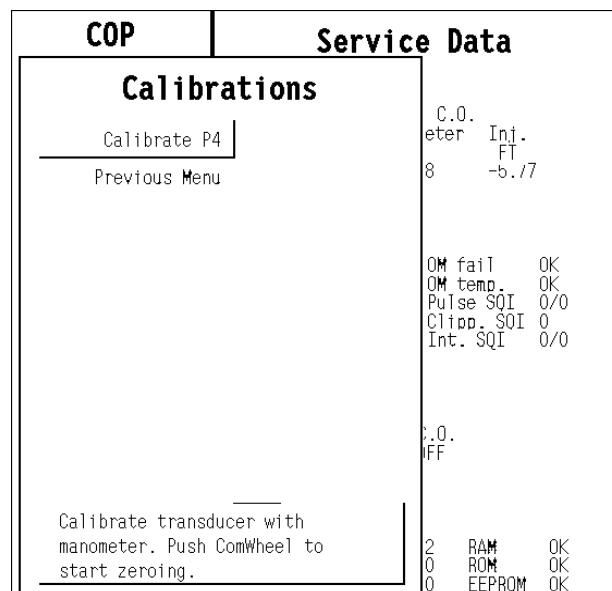
How to calibrate

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P4 connector. Select Calibrate P4. Leave the transducer at room air pressure.

2. Press the ComWheel to start zeroing.

3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.

4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.7   NIBP Module

Service menu for Non-invasive Blood Pressure Modules.

Service Data

Pressure shows the measured pressure multiplied by 10. This value is automatically zero-drift compensated.

Zero shows the difference between the zeroing value in the permanent memory (stored when the module is calibrated) and the current automatic zero-drift compensation multiplied by 10. The value can change between +20 and -20 mmHg. If the zero drift exceeds ± 10 mmHg, the module should be recalibrated.

Protect handle indicates hardware protection for EEPROM memory. It should be ON all the time in normal operation. If it is OFF, data cannot be read from or written to EEPROM, only the calibration protection can be set or reset by software. It can be turned to OFF by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which also enables *Protection ON/OFF* menu selection in the calibration menu.

Calibr. prot. shows software calibration protection and it should be OFF to enable calibration.

+15 V power refers to legacy NIBP modules. Not used in PRESTN series modules and E-PSM(P).

AD0 to **AD7** show the values of each eight channels of the A/D converter. AD7 is not used in PRESTN series modules, M-NIBP module and E-PSM(P).

```
NIBP Module          Service Data
                                  B1        B2
NIBP Demo     ▤     Pressure    000000    000000
                    Zero        -00010    000000
Calibrations  ▤
                                          AD0    -17
Safety Valve  ▤                           AD1      6
                                   .      AD2     -1
Pulse Valve   ▤                           AD3   1502
                                          AD4      2
Buttons/Leds  ▤     Protect handle   ON   AD5  -1644
                    Calibr. prot.    OFF  AD6      5
Pneumatics    ▤     +15 V power      OFF  AD7  -1505

Watchdog      ▤

Previous Menu



                    Timeouts        2    RAM    OK
                    Bad checksums   0    ROM    OK
                    Bad c-s by mod  0    EEPROM OK
```

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.

EEPROM indicates if the values stored in the permanent memory are valid.

The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.7.1 NIBP Demo

A service menu for demonstrating the oscillometric method of NIBP measurement. The menu shows the real-time pressure signals that are measured from the NIBP cuff. The measurement result is shown in the adjoining digit field.

Wave Recording is for selecting the recording option. If ON is selected, the pressure signals are printed out in real-time on the recorder.

Remove menu widens the displayed waveform area.

The menu can be closed by selecting the **Previous Menu** or just by pressing the ComWheel if the **Remove menu** was selected.

```
┌─────────────────────────────┐
│        NIBP Demo            │
│   Wave Recording │ OFF       │
│       Remove menu            │
│      Previous Menu           │
│                              │
│                              │
│                              │
│                              │
│                              │
│                              │
└─────────────────────────────┘
```
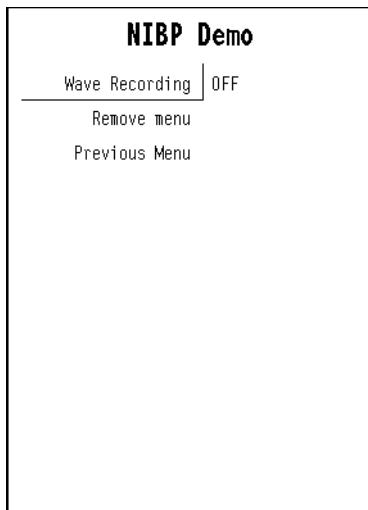
4.7.2   NIBP Calibration

Active Leak Test: Wrap an adult cuff around a pipe and connect the cuff to the module. Select the active leak test (ON). The module automatically pumps a pressure of 260 mmHg into the cuff. Wait for several seconds until the pressure stabilizes. Then check that the pressure reading does not drop more than 6 mmHg per minute. If it does, leaking point(s) should be detected and fixed. Cancel the test by selecting the Active leak test OFF.

Calibration Check: After the calibration check is selected (ON), the module zeroes the pressure transducers at the beginning of the calibration check. Do not pump pressure until the text 'Calibrating' appears in the NIBP digit field or the zeroing will fail. After the zeroing is done, manually pump pressure into the module and make sure that the same pressure values are shown both on the display and on the manometer. Pressure of both pressure channels B1 and B2 are shown. The pressure values are automatically zero-compensated, so the readings of B1 and B2 should be the same as the manometer readings.

```
NIBP Module │      Service Data
   ┌──────────────────────┐   B1        B2
   │      Calibration     │   00    000000
   │                      │   10    000000
   │  Active Leak Test │ OFF │
   │  Calibration Check  OFF │      AD0    -17
   │       Protection    OFF │      AD1      6
   │                         │      AD2     -1
   │       Calibration       │      AD3   1502
   │                         │      AD4      2
   │      Previous Menu      │ ON   AD5  -1643
   │                         │ FF   AD6      5
   │                         │ FF   AD7  -1505
   │                         │
   │                         │
   │                      │  2   RAM    OK
   │                      │  0   ROM    OK
   └──────────────────────┘  0   EEPROM OK
```

Protection: Software calibration protection (ON/OFF). Select **OFF** when calibrating. **Protection** selection becomes available in the menu after pressing the NIBP module buttons **Auto ON/OFF** and **Start/Cancel** simultaneously for 3 seconds. For M-NE(12)STPR series modules: Protection can be set ON or OFF only when the toggle switch at the bottom module is set to the right.

How to Calibrate

Calibration selection is available only when protection is OFF.

NOTE: Both channels B1 and B2 must be calibrated simultaneously.

NOTE: The module must be in the frame during the whole procedure.

NIBP calibration can be performed in the NIBP Service menu as follows:

1.   If **Protection** is **ON**, change it to **OFF** by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which enables the **Protection** selection. Then press the buttons again for 3 seconds to enable **Calibration**.

NOTE: When the buttons have been pressed, the NIBP field shows an error message 'Calibration switch on!'.

NOTE: For M-NE(12)STPR series modules: If **Protection** is **ON,** change it to **OFF** by first turning the toggle switch to the right at the bottom of the module, which enables the **Protection** selection. Then turn the toggle switch to the left to enable **Calibration**. When the switch is at the right, the NIBP field shows an error message 'Calibration switch on!'

NOTE: When calibration is enabled, a message 'Calibration not protected' appears.

2.   For proper zeroing to take place, remove the hose from the front panel connector. Select **Calibration** and push the ComWheel. Messages 'Zeroing' and 'Zeroed' will appear in the NIBP

message field. After this, a pressure bar will appear beside the menu and the text 'Calibrating' will appear in NIBP digit field.

3. Connect an external mercury manometer with a pump to the module through the both tubes of the hose. Pump up to about 200 mmHg pressure (range of 150 to 300 mmHg allowed) according to the manometer. Verify that both pressure values in the prompt field match the manometer reading. If not, adjust by turning the ComWheel.

4. When the values are equal, push the ComWheel to confirm the calibration. After a few seconds the 'Calibrated' message will appear in the NIBP digit field, which means that the calibration data has now been saved.

NOTE: When calibrating NIBP, always change the displayed pressure value slightly with the ComWheel, even in cases where the value would be correct. For example, change the value one step higher and then back one step lower. The 'Calibrated' text should appear in the display. This ensures that the calibration procedure is correctly registered and stored by the module.

5. Use the module buttons again to enable **Protection** setting and set it ON, and finally disable **Protection** setting.

4.7.3   NIBP Safety Valve

Test: Start test is for starting and **Stop test** is for stopping the Safety Valve test.

Safety Valve Data:

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see service data descriptions in section "4.7 NIBP Module".

Max. press and **2 s after stop** show the measured values at Safety Valve test.

Safety Valve Test Adult/Infant
Wrap an adult cuff around a pipe and connect the cuff to the module. Highlight **Start test** and give the ComWheel a push. The test ends automatically or when **Stop test** (appears in place of **Start test**) is pushed.

Max. press indicates the pressure at which the safety valve opens and is normally 300 ±15 mmHg for adult and 150 mmHg ±15 mmHg for infant.

```
Safety Valve        Safety Valve Data
                                   B1         B2
 ADULT               Pressure    000000     000000
                     Zero        -00010     000000
 Start Test
                                            AD0     -16
 Previous Menu                              AD1       8
                                            AD2      -1
                                            AD3    1502
                                            AD4       2
                     Protect handle   ON    AD5   -1643
                     Calibr. prot.   OFF    AD6       4
                     +15 V power      ON    AD7   -1505




                                   B1         B2
                     Max press        0          0
                     2 s after stop   0          0

                     Timeouts         2    RAM     OK
                     Bad checksums    0    ROM     OK
                     Bad c-s by mod   0    EEPROM  OK
```

2 s after stop indicates the pressure at 2 seconds after the pump has stopped and is normally > 270 mmHg for adult and > 130 mmHg for infant. If the value is less, check leakage by the active leak test.

4.7.4   NIBP Pulse Valve

Start test is for starting and **Stop test** is for stopping the test.

Set Valve lets you adjust the opening of the pulse valve.

Pulse Valve Data

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

```
Pulse Valve │    Pulse Valve Data
                                B1        B2
 Start Test     Pressure      000000    000000
                Zero          -00010    000000
 Set Valve
                                        AD0    -17
 Previous Menu                          AD1      6
                                        AD2     -1
                                        AD3   1502
                                        AD4      2
                Protect handle   ON     AD5  -1644
                Calibr. prot.   OFF     AD6      4
                +15 V power      ON     AD7  -1504


                                        Pulse
                                        Valve
                                         150

                Interval 240 mmHg -> 50 mmHg    0s



                Timeouts          2    RAM    OK
                Bad checksums     0    ROM    OK
                Bad c-s by mod    0    EEPROM OK
```

How to check Pulse Valve

Wrap an adult cuff around a pipe and connect the cuff to the module. Select **Start test** and push the ComWheel. The pressure rises beyond 240 mmHg and stops. The pulse valve opens. The module counts the time it takes for the pressure to go down from 240 mmHg to 50 mmHg and displays it on the screen. The test can be manually stopped by selecting **Stop test**.

The valve can be adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First select **Set Valve** and push the ComWheel. See the pulse valve value and adjust it by turning the ComWheel. Then push the ComWheel to confirm the value.

The **Interval 240 mmHg -> 50 mmHg** time should be less than 60 seconds when the valve is 150 and less than 10 when fully opened (255). When fully closed (0), the system should be airtight and the pressure does not drop. Depending on an individual, the pulse valve may remain closed up to approx. value 100.

If the measured time deviates much from those above, then the pulse valve or its tubes are faulty.

4.7.5   NIBP Buttons/Leds

The selections *Auto ON/OFF, Manual ON/OFF*, *STAT ON/OFF*, and *Measur. ON/OFF* have effect only on the NIBP module, M-NIBP.

Buttons/Leds Data

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

Buttons Checking

The front panel keys function is confirmed by pressing and releasing the key and observing that **OFF** turns to **ON** at **Auto On/Off**, and **Start Cancel**. Set Cycle Time and STAT On/Off are not in use with E-PSM(P).

```
┌─────────────┐
│Buttons/Leds │   Buttons/Leds Data
│             │                      B1        B2
│ Auto    ON  │   Pressure        000000    000000
│             │   Zero            -00010    000000
│ Manual  ON  │
│             │                             AD0     -17
│ STAT    ON  │                             AD1       6
│             │                             AD2      -1
│ Measur. ON  │                             AD3    1502
│             │                             AD4       1
│ Previous Menu│  Protect handle      ON    AD5   -1643
│             │   Calibr. prot.     OFF    AD6       4
│             │   +15 V power        ON    AD7   -1505
│             │
│             │
│             │      Auto    Set     STAT    Start
│             │      On/Off  Cycle   On/Off  Cancel
│             │              Time
│             │      OFF     OFF     OFF     OFF
│             │
│             │
│             │
│             │   Timeouts          2   RAM    OK
│             │   Bad checksums     0   ROM    OK
│             │   Bad c-s by mod    0   EEPROM OK
└─────────────┘
```

4.7.6   NIBP Pneumatics

Start Pump/Stop Pump: A manual control for the pump. The selection changes to **Stop Pump** when the pump turns on.

Open Exh1/Close Exh1: A manual control for the exhaust valve 1. The selection changes to **Close Exh1** when the valve is opened. This function is not in use with E-/ M-PRESTN and E-PSM(P) modules.

Open Exh2/Close Exh2: A manual control for the exhaust valve 2. The selection changes to **Close Exh2** when the valve is opened.

Open Zero valve: A manual control for the zero valve. This function is not in use with E-/ M-PRESTN and E-PSM(P) modules.

Set Valve: The opening of the pulse valve is adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First push the ComWheel, then turn it to adjust the value on the screen and finally push to set the value.

```
Pneumatics          Pneumatics Data
                                 B1        B2
Start Pump           Pressure    000000    000000
                     Zero        -00010    000000
Open  Exh1
                                           AD0    -17
Open  Exh2                                 AD1      6
                                           AD2     -1
Open Zerovalve                             AD3   1502
                                           AD4      2
Set Valve            Protect handle   ON   AD5  -1643
                     Calibr. prot.   OFF   AD6      4
Reset Clock          +15 V power      ON   AD7  -1505

Previous Menu


                       Pump   Exh1   Exh2    Pulse
                              Valve  Valve   Valve
                       OFF   CLOSED CLOSED       0

                     Interval 20 mmHg -> 185 mmHg    0s



                     Timeouts          2   RAM    OK
                     Bad checksums      0   ROM    OK
                     Bad c-s by mod     0   EEPROM OK
```

Reset Clock will zero the time on the display. This function is not in use with E-/ M-PRESTN and E-PSM(P) modules.

Pneumatics Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "".

Pump, Exh1 Valve, and **Exh2 Valve** show their states. NOTE: **Exh1 Valve** has no effect on the module.

Pulse Valve shows how much the valve is opened (0 to 255) during Valve Setting.

How to check Interval 20 mmHg -> 185 mmHg

Select **Start pump** at different combinations of the valves open/closed and push the ComWheel. The module counts the time it takes for the pressure to go up from 20 mmHg to 185 mmHg and displays it. When all the valves are closed, the pump should be able to pump the pressure in about 1 to 4 seconds into an adult cuff wrapped around a pipe. The pump does not stop without selecting **Stop Pump** by pushing the ComWheel.

4.7.7   NIBP Watchdog

These menu items have only effect on the M-NIBP modules. They do not effect other NIBP modules.

Test ADULT: is to test watchdog timer in adult mode (120 to 140 seconds).

Test INFANT: is to test watchdog timer in infant mode (about 60 to 70 seconds).

Stop Test: is for stopping the test.

Watchdog Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

Watchdog Interval: shows the time the +15 Vdirty stays on during the test.

```
 Watchdog         │      Watchdog Data
                  │                  B1        B2
 Test ADULT       │   Pressure     000000    000000
                  │   Zero         -00010    000000
 Test INFANT      │
                  │                          AD0     -17
 Stop Test        │                          AD1       5
                  │                          AD2      -1
 Previous Menu    │                          AD3    1502
                  │                          AD4       2
                  │   Protect handle    ON   AD5   -1644
                  │   Calibr. prot.    OFF   AD6       4
                  │   +15 V power       ON   AD7   -1504
                  │
                  │
                  │
                  │   Watchdog Interval     0 s
                  │
                  │
                  │   Timeouts           2   RAM     OK
                  │   Bad checksums      0   ROM     OK
                  │   Bad c-s by mod     0   EEPROM  OK
```

How to test Adult watchdog time

Select Test ADULT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 120 to 140 seconds.

How to test Infant watchdog time

Select Test INFANT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 60 to 70 seconds.

4.8   NMT

Service menu for Neuromuscular Transmission Module, E-NMT or M-NMT.

Start Curr. test is a test where the module itself checks the difference between a given current and the measured current. A 3 kΩ resistance should be connected between the stimulus electrodes before starting the test. All the currents checked will be displayed on the service data screen. After the current value, the status of the test is shown. If the test is not passed, send the module back to the factory for calibration.

T1%/ref T1% / ref gives a selection for changing settings related to the NMT MechanoSensor. A setting of **3** should always be used for normal monitoring. The settings **1** and **2** are for research purposes only.

Record Data prints out the displayed service data and circuit board information (id., serial number, and software id.) on the recorder.

```
  NMT                Service Data

NMT Setup      ▥   Cable:      EMG
                   Cable check value:      1
Start Curr. test
                   Module keys:   Start-up    Stop/Cont.
T1%/ref         3
                   Stimulus mode: TOF   Measurement: ON
Record Data
                   T1%       1162    Absolute T1    2166
Previous Menu      T2%       1162    Absolute T2    2166
                   T3%       1160    Absolute T3    2162
                   T4%       1161    Absolute T4    2164
                   Ratio%     999    Ref            1863

                   Noise       52
                   Offset    2525




                   Curr set   233    Curr meas      243
                   Pulses     236

                   Piezo probe: T1% OFF  Ref.search ON

                   Timeouts         2   RAM     OK
                   Bad checksums    0   ROM     OK
                   Bad c-s by mod   0   EEPROM  OK
```

Service Data

Cable shows the type of cable being used.

Cable check value shows the bit amount. To check the value for each cable, see the following chart:

- EMG   -100...+100
- Cable OFF   >1950
- Piezo   900...1100
- Regional block 600....800

Module keys checks the function of the module keys. A blue background appears at the back of the text when a key is pressed for more than one second.

Stimulus mode shows the selected stimulus. Stimulus mode can be changed using the NMT Setup menu.

Measurement indicates ON/OFF.

T1%, T2% shows the measured response. A value of 1000 corresponds to 100%.

Absolute T1, T2 shows the voltage measured from the A/D converter.

Noise indicates the interference just before the measurement. A typical value is <100.

Offset is an average of the noise measurement. A typical value is 510.

Curr set is the selected current, a value of 700 corresponds to 70 mA.

Curr meas is the measured current, a value of 700 corresponds to 70 mA.

Pulses indicates pulses the module has produced.

Piezo probe T1% and Ref. search shows information related to the MechanoSensor settings.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The non-zero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum in the EPROM is in accordance with the software calculated value.

EEPROM indicates if the values stored in the permanent memory are valid.

The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.8.1   NMT Setup

Start-up is for starting the neuromuscular transmission measurement.

Stop/Continue is for stopping/continuing the measurement.

Stimulus Mode is for changing the stimulus mode. The choices are: **TOF** - Train of Four, **DBS** -Double Burst Stimulation or **ST** - Single Twitch mode.

Cycle Time is for changing the time interval for NMT measurement. The choices are:
for TOF and DBS: Manual and from 10 sec to 15 min.
for ST: 1, 10 and 20 sec.

Current is for changing the stimulus current strength. The current is either supramaximal (automatic start-up search) or manually selected.

Pulse Width is for selecting the desired pulse width. The choices are: 100, 200 or 300 µs.

```
NMT              Service Data
   NMT Setup
                                1
    Start-up
      Stop            t-up       Stop/Cont.
                         Measurement:  ON
  Stimulus Mode   TOF
    Cycle Time    20 sec      Absolute T1    2162
                             Absolute T2    2154
      Current     S 23mA      Absolute T3    2158
                             Absolute T4    2148
   Pulse Width    200 µs      Ref            1863
  Previous Menu



                              Curr meas      243

         -
                              Ref.search ON
                                RAM      OK
                                ROM      OK
                                EEPROM   OK
```

4.9   Oxygen Saturation Modules, E-NSAT, M-NSAT, M-OSAT

N/OSAT Data

NOTE: Preamp Error is indicated on the service menu, even though module contains MP-204 board.

NOTE: The status and error indicators are not valid for the M-OSAT, E-NSAT and the M-NSAT..04 revision.

PR shows the pulse rate value [bpm] calculated from the pleth.

SpO$_2$% shows the oxygen saturation value multiplied by 100.

Next are listed the **messages** that are sent from the module to the monitor. Digit '0' means that the message is not active, '1' is for the active one.

Preamp Error indicates 'Yes' if the Preamp (MP-203(4)) board detects an error.

```
┌──────────────┬───────────────────────────┐
│   N/OSAT     │        SAT Data           │
│              │                           │
│Previous Menu │                           │
│              │                           │
│              │   PR              73      │
│              │   SpO2%         9800      │
│              │                           │
│              │                           │
│              │   NoProbe          0      │
│              │   PulseSearch      0      │
│              │   NoPulse          0      │
│              │   CheckProbe       0      │
│              │                           │
│              │   Preamp Error       No   │
│              │   QUART Error        No   │
│              │   I/O Error          No   │
│              │                           │
│              │                           │
│              │   Timeouts         0      │
│              │   Bad checksums    0  ROM  OK │
│              │   Bad c-s by mod   0      │
└──────────────┴───────────────────────────┘
```

QUART Error indicates 'Yes' if an error is detected in the operation of QUART that is located in the Interface board.

I/O Error indicates 'Yes' if an error occurs in the communication between Preamp (MP-203(4)) and Interface board.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated. The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.10 More

```
            Parameters
              More...
      Interface  ▤
           TONO  ▤
      EEG & EP   ▤
           BIS   ▤
        Entropy  ▤
  DIS Interfacing ▤
       Previous Menu
```

4.11 Interface module, E-INT, M-INT

Gases, SpO$_2$, NIBP, Spirometry, SvO$_2$/C.O. indicate the parameters for which service data is available. The data which can be seen on those pages is raw data from the interfaced monitors, which will be processed for the normal screen.

```
Interface              Service Data

Gases          ▣     I-INT:
                          id:              state:wait
SpO2           ▣
                     B-INT:
NIBP           ▣     ch:0  id:Ultima       state:search
                     ch:1  id:Ultima       state:search
Spirometry     ▣     ch:2  id:Ultima       state:search
                     ch:3  id:Ultima       state:search
SvO2/C.O.      ▣
                     rt : none
Previous Menu        rt : none




                     Timeouts        2   RAM    OK
                     Bad checksums   0   ROM    OK
                     Bad c-s by mod  0
```

Service Data

I-INT: Indicates the status of the interface via the UPI section.

B-INT: Indicates the status of the interface via the 4 interface channels of B-INT or two channels of E-INT/ M-INT module.

id: The name of the interfaced monitor, e.g. Ultima.

state: describes the state of the connection, alternatives are:
'init' - the channel is initialized
'wait' - the monitor is waiting for the external monitor
'online' - the connection is ready
'search' - the external monitor is being searched

rt: real time values that are available via the interface.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the ROM is in accordance with the software calculated value.
The state is either **OK**, **Fail** or **?** (module not in place or a communication error).

4.11.1 Gases

The data on this page is the raw data received from the interfaced monitor. This data will be processed further for the normal screen.

```
Interface              Gas data

Previous Menu       id:
                    Active No      Timeout No

                    RR             ---
                    EtCO2          ---
                    FiCO2          ---
                    EtO2           ---
                    FiO2           ---
                    EtN2O          ---
                    FiN2O          ---
                    EtAA           ---
                    FiAA           ---
                    AAid           ---
                    Pint           ---
                    Pamb           ---
                    sts            8001




                    Timeouts      33739    RAM    ?
                    Bad checksums      0    ROM    ?
                    Bad c-s by mod     0
```

4.11.2 SpO2

The data on this page is the raw data received from the interfaced monitor. This data will be processed further for the normal screen.

```
Interface             SpO2 data

Previous Menu       id:
                    Active No      Timeout No

                    PR             ---
                    SpO2%          ---
                    mod%           ---
                    ired           ---
                    red            ---
                    sts            8001

                    ProbeOff        0
                    NoProbe         0
                    PulseSearch     0




                    Timeouts      34161    RAM    ?
                    Bad checksums      0    ROM    ?
                    Bad c-s by mod     0
```

4.11.3 NIBP

The data on this page is the raw data received from the interfaced monitor. This data will be processed further for the normal screen.

```
Interface          NIBP data

Previous Menu     id:
                  Active No     Timeout No

                  Hour          ---
                  min           ---
                  sec           ---
                  mode          ---
                  Sys           ---
                  Mea           ---
                  Dia           ---
                  PR            ---




                  Timeouts      34769    RAM    ?
                  Bad checksums      0    ROM    ?
                  Bad c-s by mod     0
```

4.11.4 Spirometry

The data on this page is the raw data received from the interfaced monitor. This data will be processed further for the normal screen.

```
Interface        Spirometry data

Previous Menu     id:
                  Active No     Timeout No

                  MVexp         ---
                  MVinsp        ---
                  TVexp         ---
                  TVinsp        ---
                  V             ---
                  Compl         ---
                  Ppeak         ---
                  Pplat         ---
                  PEEP          ---
                  I:E           ---

                  Usts         8001
                  Sts          8001




                  Timeouts      35139    RAM    ?
                  Bad checksums      0    ROM    ?
                  Bad c-s by mod     0
```

4.11.5 Sv02/C.O.

The data on this page is the raw data received from the interfaced monitor. This data will be processed further for the normal screen.

```
┌─────────────────┬──────────────────────────────┐
│ Interface       │        Sv02 data             │
│                 │                              │
│ Previous Menu   │  id:                         │
│                 │  Active No    Timeout No      │
│                 │                              │
│                 │  Sv02        ---             │
│                 │  Mode        ---             │
│                 │  Cald        ---             │
│                 │  IntLo       ---             │
│                 │  IntHi       ---             │
│                 │  IntAve      ---             │
│                 │                              │
│                 │  COAve       ---    ---       │
│                 │  COTime      ---     0        │
│                 │  COAm        ---    ---       │
│                 │  Btemp       ---             │
│                 │  COvalue     ---             │
│                 │  ICOvalue    ---             │
│                 │                              │
│                 │                              │
│                 │                              │
│                 │  Timeouts    35584   RAM   ? │
│                 │  Bad checksums    0  ROM   ? │
│                 │  Bad c-s by mod   0          │
└─────────────────┴──────────────────────────────┘
```

4.12 Tonometry

Service menu for Gastric Tonometry Module.

Service Data

Tonometry: Another route to reach Tonometry setup menu.

PressSensCal: A selection to enter the module pressure sensor calibration menu.

System Test: A selection to enter the module system test.

CO2 Sensor: A selection to enter the module CO_2 sensor menu.

Pneumatics: A selection to enter the module pneumatics menu.

AD: A selection to enter the module AD value display.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

```
Service Data          TONO

Tonometry      ▣
                      Statuses (HEX)
PressSensCal   ▣        General       0000
                        HW            0000
System Test    ▣        Module key    0000

CO2 Sensor     ▣      Error Statuses (HEX)
                        General error 0000
Pneumatics     ▣        Pneuma error  0000
                        HW error      0000
AD             ▣        Testbit       0000

Record Data           Voltages
                        Vdd            5.00
Previous Menu           5vdc           4.93
                        15vdc         14.61
                        Pneuma voltage 14.58
                        15V dirty     14.64


                      Timeouts      2   RAM   OK
                      Bad checksums 0   ROM   OK
                      Bad c-s by mod 0  EEPROM OK
```

TONO

Statuses (HEX): See APPENDIX A How to read HEX numbers.

General: Module general status. See Table 2 Module general status for a detailed description of the message.

Table 2   Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

HW   Module hardware status. See Table 3 Module hardware status for a detailed description of the message.

Table 3   Module hardware status

bit 0	Lamp ON
bit 1	Stepper motor ON
bit 2	Zeroing valve ON
bit 3	Pump valve ON
bit 4-15	Not used

Module key   Module keyboard status. See Table 4 Module keyboard status for a detailed description of the message.

Table 4   Module keyboard status

bit 0	Button 1 (start/stop) pressed
bit 1	Button 2 (Lab.Data) pressed
bit 2-15	Not used

Error Statuses (HEX):

General error   Module general error status. See Table 5 Module general error status for a detailed description of the message.

Table 5   Module general error status

Bit	Description	What to do
bit 0-1	Not used.	-
bit 2	Zeroing error. Zero gas signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 3	CO_2 measurement error. CO_2 signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 4	Measurement error. Sensor temperature, measurement pressure or absorbance is out of limits.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 5	Calibration error. Failure in calibration.	Recalibrate.
bit 6	Pneumatic error.	See pneumatic error status bits for details.
bit 7	Lamp pulsing error.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 8-15	Not used.	-

Pneuma error   Module pneumatics error status. See Table 6 Module pneumatics error status for a detailed description of the message.

Table 6   Module pneumatics error status

Bit	Error label	Description	What to do
0	pumping error	Stepper motor is not able to generate negative pressure at the pump pressure sensor during zeroing.	Check the function of the stepper motor.
1	eq. to amb. press failed	Before filling the catheter, the pressure in the module tubing is equilibrated to the ambient pressure by switching the pump valve on and off. If ambient pressure is not reached, this error is shown.	Calibrate the pressure sensors. Check the pump valve function.
2	tubing/zero block occl	Pressure at the pump pressure sensor gets too low, when air is aspirated though the zeroing valve.	Check tubing/valves for occlusion.
8	press sens values differ	Pump pressure and catheter pressure readings differ more than 50 mbars.	Calibrate the pressure sensors.
9	pneuma fatal error	This error is shown, if the pneumatic error occurred is considered fatal.	Check for other pneumatics errors.
10	cath press too low	Catheter pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
11	cath press too high	Catheter pressure reading is above reasonable pressure values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.
12	pump press too low	Pump pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
13	pump press too high	Pump pressure reading is above reasonable values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.

HW error   Module hardware error status. See Table 7 Module hardware error status for a detailed description of the message.

Table 7   **Module hardware error status**

bit 0	Lamp error
bit 1, 2, 3	not used
bit 4	CPU EEPROM error
bit 5	Sensor EEPROM error
bit 6	Internal AD converter error
bit 7	External AD converter error
bit 8	CO_2 termopile error
bit 9	Reserved
bit 10	Temperature detector error
bit 11	Pump pressure sensor error
bit 12	Catheter pressure sensor error
bit 13	Pneumatic power failure
bit 14-15	Not used

Testbit   Testbit is a module production phase test status and is always 0000 (HEX). If the testbit status is $\neq$ 0000, then the module should be returned to the factory.

Voltages   **Vdd**; 5 V digital units driving voltage received from the module frame.

5vdc; 5 Volts of the module derived internally from 15vdc.

15vdc; 15 Volts of the module received from the module frame.

Pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15V dirty.

15V dirty; 15 V voltage received from the module frame.

4.12.1 Tonometry

This is another route to reach Tonometry setup menu, **Others** - *Tonometry*. For a detailed description on how to use this menu see "User's Reference Manual".

Start / Stop Cycling is for starting or stopping the measurement.

Display with PgCO2 is for defining the calculated value displayed with PgCO2. The choices are *Pg-Pa, Pg-ET* or *pHI*.

Lab Data is for entering the blood gas values nad calculations.

PgCO2 Calibration is for calibrating the tonometry.

PgCO2/Pg-ET Alarms is for disabling/enabling alarms and adjusting the alarm limits.

```
Service Data                    TONO
         Tonometry
     Stop Cycling                  0000
                                   0000
 Display with PgCO2   Pg-ET        0000
         Lab Data     ▤
   PgCO2 Calibration  ▤            0000
                                   0000
  PgCO2-Pg-ET Alarms  ▤            0000
                                   0000
      Previous Menu
                                    5.00
                                    4.93
                                   14.61
                                   14.61
                                   14.61

  Stop automatic tonometry
  measurement.                   2  RAM     OK
                                 0  ROM     OK
                                 0  EEPROM  OK
```
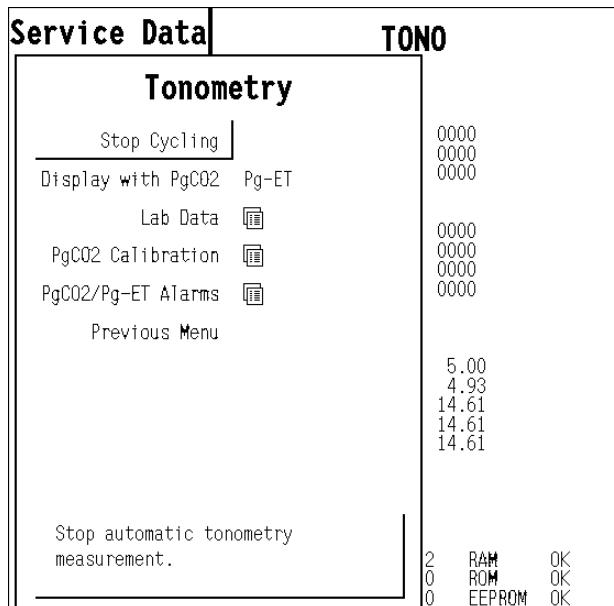
How to calibrate PgCO$_2$

1. Connect the calibration gas sampling line to the regulator and to the module's catheter connector.

2. Select **PgCO2 Calibration**.

3. Wait until the text 'Start feeding gas and press ComWheel. Feed gas until Adjust message is displayed' appears. Open the regulator and start feeding gas. Press the ComWheel and continue feeding gas until the text 'Adjust' appears on the display.

4. Check that the displayed values match the values on the calibration gas container. Adjust with the ComWheel, if necessary.

5. If airway gases are monitored, it is recommended to calibrate the airway gases at the same time.

4.12.2 Press Sensor

Start Calib.: A selection to start a module pressure sensor calibration sequence. The procedure is guided online.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO service data

Amb Press; ambient pressure measured by the pressure sensor. All the pressure values are given in both mmHg and mbar on this page.

Pump Press; pressure measured from the pumping unit.
Cath Press; pressure measured from the catheter line.

User Cal Press; pressure that the user sets during the calibration sequence according to the pressure that is applied to the catheter port. The set value should be close to 100 mmHg.

```
┌─────────────┬──────────────────────────────────┐
│Press Sensor │              TONO                │
│             │                                  │
│ Start Calib.│                                  │
│             │                   mmHg      mbar │
│ Record Data │ Amb Press          757      1009 │
│ Previous Menu│                                 │
│             │                   mmHg      mbar │
│             │ Pump Press         757      1009 │
│             │ Cath Press         770      1027 │
│             │                                  │
│             │ User Cal Press       0         0 │
│             │ User Amb Press       0         0 │
│             │                                  │
│             │ Store               NO           │
│             │                                  │
│             │                                  │
│             │ Last Press calibration date:     │
│             │      31 Dec 2037   13:12         │
│             │                                  │
│             │ Make sure that catheter connector│
│             │ is open to room air and start    │
│             │ calibration.                     │
└─────────────┴──────────────────────────────────┘
```

User Amb Press; pressure that the user sets during the calibration sequence according to the current ambient pressure in the room.

Store; a selection for storing/discarding the newly gained calibration values.

Last Press calibration date; data read from the module that tells when the module has last been calibrated.

4.12.3 System Test

Start Test: A selection to start the automatic system test sequence. The procedure is guided online.

Stop Test: A selection to stop the automatic system test sequence.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

System test results; detailed information of the test results of different system parts. The meaning of the messages:

- "OK", the part successfully passed the test

- "FAIL", the part failed in the test

- "N/A", the test could not be carried out properly.

See Table 8 Description of system test for a detailed description of the tested parts.

```
System Test            TONO

Start Test         Pressure sensor values (mbar):
                   Cathpres   Ambpres    Pumppres
Stop Test          1027       1009       1009

Record Data
                   System test results:
Previous Menu      Pump unit function
                   Cath press = pump press
                   Tubing leak test
                   Pump unit leak test
                   Cath conn. leak test
                   Block test
                   Zero valve function
                   Pump valve function




                   Close catheter connector and start
                   test.
```

Table 8   Description of system test

Test label	Description	If test fails
Pump unit function	Stepper motor aspirates/pushes room air through the zeroing valve. If the stepper is working properly, it is able to generate small negative/positive pressure at the pump unit pressure sensor.	Check the function of stepper motor.
Cath press = pump press	Pump pressure sensor and catheter pressure sensor readings are compared at three pressures: at ambient pressure, at approx. +100 mbar and –100 mbar.	Calibrate the pressure sensors.
Tubing leak test	The air tightness of the module inner tubing from the zeroing valve to the pump valve is tested.	Check tubing and connections for leaks.
Pump unit leak test	The air tightness of the pump unit is tested.	Check pump unit for leaks.

Test label	Description	If test fails
Cath conn. leak test	The air tightness of the zeroing unit and catheter connector is tested.	Make sure that the catheter connector is properly closed during the test. Check the zeroing unit and the catheter connector for leaks.
Block test	Air is aspirated through the zeroing valve. If pressure at the pump pressure sensor drops too much, the tubing/valves from the zeroing valve to the pump pressure sensor is blocked.	Check the tubing/valves for blocks.
Zero valve function	Module pneumatic system pressurized and then the zeroing valve is opened to room air. If the pressure does not drop, the zeroing valve may not be functioning.	Check the function of the zeroing valve.
Pump valve function	Module pneumatic system pressurized and then the pump valve is opened to room air. If the pressure does not drop, the pump valve may not be functioning.	Check the function of the pump valve.

4.12.4 CO_2 Sensor

Lamp ON/OFF: A selection to toggle the sensor lamp on and off.

Meas Signal: A selection to start an automatic signal measurement sequence. This sequence measures sensor lamp signal levels.

Meas Zero: A selection to start an automatic zeroing measurement sequence.

Meas Gas: A selection to start an automatic gas measurement sequence. This sequence first performs the zeroing measurement. Then it measures the CO_2 concentration of the sample of arbitrary gas aspirated from the catheter port.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

```
┌──────────────┬───────────────────────────────┐
│ CO2 Sensor   │           TONO                │
│              │                               │
│ Lamp ON/OFF  │  Calib gain           9968    │
│              │  Lamp on current      133mA   │
│ Meas Signal  │  Lamp off current       2mA   │
│              │  Block temp         30.22C    │
│ Meas Zero    │  Detector offset      1.11V   │
│              │                               │
│ Meas Gas     │  Lamp status          OFF     │
│              │                               │
│ Record Data  │  CO2 AD               1424    │
│              │  CO2 signal           1024    │
│ Previous Menu│  CO2 zero             1377    │
│              │                               │
│              │  CO2 absorbance      0.1287   │
│              │  CO2 concentration    8.84%   │
│              │                               │
│              │                               │
│              │           TEMP(C)  PRESS(mbar)│
│              │     MEAS   29.08     969.2    │
│              │     ZERO   29.01    1009.3    │
└──────────────┴───────────────────────────────┘
```

TONO

Calib gain; CO_2 measurement gain factor that is set in calibration.
Lamp on current; sensor lamp current when lit.
Lamp off current; sensor lamp current when off.
Block temp; sensor temperature [°C] (in degrees centigrade).
Detector offset; CO_2 detector offset voltage.

Lamp status; displays whether the sensor lamp is on or off.

CO2 AD; signal from CO_2 sensor thermopile (AD counts).
CO2 signal; thermopile signal maximum – minimum when the lamp is blinking (AD counts).
CO2 zero; thermopile signal maximum - minimum during sensor zeroing when the lamp is blinking (AD counts).

CO2 absorbance; calculated light absorbance during CO_2 measurement.
CO2 concentration; CO_2 concentration (%) in sensor (does not include compensations related to catheter measurement).

MEAS TEMP; CO_2 sensor temperature during signal measurement [°C].
MEAS PRESS; CO_2 sensor pressure during signal measurement [mbar].
ZERO TEMP; CO_2 sensor temperature during zeroing measurement [°C].
ZERO PRESS; CO_2 sensor pressure during zeroing measurement [mbar].

4.12.5 Pneumatics

Zero valve: A selection to toggle the zero valve on/off.

Press valve: A selection to toggle the pump valve on/off.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

Pneuma Power; displays whether electricity has been connected to the pneumatics system or not.
Zero valve; displays whether the zero valve is on or off.
Pump valve; displays whether the pump valve is on or off.
Gas removed count; displays how many times gas is removed from the catheter during a measurement cycle.

```
┌─────────────┬─────────────────────────────┐
│ Pneumatics  │           TONO              │
│             │                             │
│ Zero valve  │ Pressure sensor values (mbar):│
│             │ Cathpres   Ambpres   Pumppres│
│ Pump valve  │  983        1009       974 - │
│             │                             │
│ Record Data │ Pneuma Power          ON    │
│             │ Zero valve            ON    │
│ Previous Menu│ Pump valve           ON    │
│             │ Gas removed count     0000  │
│             │                             │
│             │ Pneumatic errors:           │
│             │ pumping error         NO    │
│             │ eq. to amb. press failed NO │
│             │ tubing/zero block occl   NO │
│             │ press sens values differ NO │
│             │ cath press too high   NO    │
│             │ cath press too low    NO    │
│             │ pump press too high   NO    │
│             │ pump press too low    NO    │
│             │ pneuma fatal error    NO    │
└─────────────┴─────────────────────────────┘
```

Pneumatic errors; detailed information of the performance of different pneumatics system parts.
The meaning of the messages:
'NO', the part performed OK during the measurement = 'this error did not occur'
'YES', the part failed during the measurement = 'this error did occur'

See Table 6 Module pneumatics error status for a detailed description of the messages.

4.12.6 AD

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

All the numbers in this section are AD counts, i.e. computer internal data.

EXTERNAL ADC

CO2; CO_2 sensor CO_2 signal.

temp; CO_2 sensor temperature signal.

cath press; pressure measured from the catheter line.

pump press; pressure measured from the pumping unit.

INTERNAL ADC

VDD; 5 V digital units driving voltage received from the module frame.

5V; 5 Volts of the module derived internally from 15vdc.

15V; 15 Volts of the module received from the module frame.

pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15 V dirty.

CO2 det offset; CO2 detector offset voltage.

lamp current; CO2 sensor lamp current.

15V dirty; 15 V voltage received from the module frame.

```
     AD                        TONO

 Record Data
                     EXTERNAL ADC
 Previous Menu          CO2                  1429
                        temp                  803
                        cath press           2207
                        pump press           2163

                     INTERNAL ADC
                        VDD                   513
                        5V                    505
                        15V                   499
                        pneuma voltage        498
                        CO2 det offset        225
                        lamp current           11
                        15V dirty             499
```

4.13 EEG & EP

Service menu for EEG Module for electroencephalography and evoked potentials (EP) measurements.

Check Electr.: Headbox measures impedance of electrodes. Works the same way as from EEG menu or the headbox/module button.

Start AEP: AEP measurement is started with current AEP settings.

Module: Service data is changed to the module view (some of the data in this view is though from headbox).

Headbox: Service data is changed to headbox view.

```
┌──────────────────────────────────────────────────┐
│  EEG & EP      Measurement: ON   Montage:      1   │
│                                  HB Montage:   0   │
│  Check Electr.                   Montage Type: Bip │
│                   EP Start/Stop                    │
│  Start AEP        Imp. Check                       │
│  Module      ◄    Imp. Meas.    0                  │
│                   Headbox Off   0                  │
│  Headbox                                           │
│                   EP Meas.      0                  │
│  Setup      ▦     Sending EP    0                  │
│                   Par. Error    0                  │
│  Previous Menu    Reserved1     0                  │
│                   Reserved2     0                  │
│                                                    │
│                                                    │
│                   HB Mod Timeouts        0         │
│                   HB Mod Bad Checksum    0         │
│                   Mod HB Bad Checksum    0         │
│                                                    │
│                   Mod Mon Timeouts       2         │
│                   Mod Mon Bad Checksum   0         │
│                   Mon Mod Bad Checksum   0         │
│                                                    │
│                   RAM     OK                       │
│                   ROM     OK                       │
│                   EEPROM  OK                       │
└──────────────────────────────────────────────────┘
```

Service data in module view

Measurement shows whether the EEG measurement is ON or OFF. Measurement should start by itself when the leads have been on for about 15 seconds.

Montage shows the active montage in monitor.

HB Montage shows the montage attached to headbox. 0 means no montage, 1 basic, 2 general, 3 AEP, 4 Mont4, etc. up to 8, which means Mont8.

Montage Type shows whether the montage is bipolar or referenced.

EP Start/Stop is highlighted when the EP Start/Stop button is pressed in headbox or module.

Imp. Check is highlighted when the Imp. Check button is pressed in headbox or module.

Imp. Meas. shows 1 if the impedance measurement is on in the module.

Headbox Off shows 1 if the headbox cable is not connected to the module.

EP Meas. shows 1 if the evoked potential measurement is active in the module.

Sending EP shows 1 if the module has acquired 100/200 new epochs and is sending them to the monitor.

Par. Error shows 1 if the evoked potential parameters active in the module are conflicting with each other.

Reserved 1 is reserved for future use.

Reserved 2 is reserved for future use.

HB Mod Timeouts is a cumulative number that indicates how many times the headbox has not responded to the module's inquiry.

HB Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the headbox to the module.

Mod HB Bad Checksum is 1 if there has been errors in the messages from the module to the headbox.

Mod Mon Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.

Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.

EEPROM indicates if the values stored in the permanent memory are valid.

The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Service data in Headbox view

EP Start/Stop is highlighted when the EP Start/Stop button is pressed in the headbox or module.
Imp. Check is highlighted when the Imp. Check button is pressed in the headbox or module.

Active shows 1 if the channel is active.
Lead off+ shows the lead off status of all plus electrodes. 0 means that the lead is on and 1 that the lead is off.
Lead off- shows the lead off status of all minus electrodes. 0 means that the lead is on and 1 that the lead is off.

Imped+ shows the impedance of plus electrodes of the last impedance check in all channels.
Imped- shows the impedance of minus electrodes of the last impedance check in all channels.

```
  EEG & EP        EP Start/Stop
                  Imp. Check
 Check Electr.
                           1    2    3    4
 Start AEP
                  Active    1    1    1    1
 Module           Lead off+ 0    0    0    0
                  Lead off- 0    0    0    0
 Headbox       ◄
                  Imped.+  2.2  2.2  2.2  2.3  kOhm
 Setup                    Imped.-  1.9  1.9  1.9  1.9  kOhm
 Previous Menu
                  BSR       2    2    2    2
                  Artefact  0    0    0    0
                  Noise     0    0    0    0

                  EMG AD          560
                  Leadset AD      199

                  Bipolar           1
                  60 Hz             0
                  Imp. Meas.        0
                  Imp. Check Failed 0

                  EP Meas.          0
                  High EP Sampl. Rate  0
                  EP Epoch Points  241
                  EP Channels        2

                  HB Rom Error       0
```

BSR shows the burst-suppression classification of EEG waveforms. 0 means artifact, 1 suppression, 2 burst and 3 invalid (the EEG is not classified).
Artefact shows the artefact status of all channels. 0 means that there are no artefacts on the signal and 1 means that there are artefacts.
Noise shows 1 if the activity of FEMG is too high for clean EEG signal and that EEG is not probably reliable.

EMG AD shows the latest AD conversion result of FEMG signal without any filtering or scaling.
Leadset AD shows the latest AD conversion result of lead set signal without any scaling.

Bipolar shows the montage type that is active in the module and headbox. 1 means bipolar and 0 referenced.
60 Hz is 1 if the power frequency filter is set for 60 Hz power frequency.
Imp. Meas. shows 1 if the impedance measurement is on in the headbox.
Imp. Check Failed shows 1 if the impedance check has failed.

EP Meas. shows 1 if the evoked potential measurement is active in the headbox.
High EP Sampl. Rate shows 1 if the headbox uses higher sampling rate for 10 ms EP measurement.
EP Epoch Points shows the number of samples collected for each epoch.
EP Channels shows the number of channels used in EP measurement.

Hb ROM Error is 1 if the checksum at the EPROM is not in accordance with the one the software has calculated.

4.13.1 EEG & EP Setup

The items in the setup menu are a collection of items in normal EEG and EP menus. There are no special service settings in this menu.

Imp. Cycle: Impedance measurement repetition time.

Select Montage: Selection of headbox's electrode configuration.

EEG Channels: Number of active channels in EEG measurement.

Montage Type: Selection of bipolar (Bip)/referenced (Ref) montage.

Cycle: EP measurement repetition time.

Stim. Frequency: EP measurement's stimulation frequency.

Stim. Intensity: Intensity of EP stimulus.

```
EEG & EP      Measurement: ON    Montage:       2
                                 HB Montage:     2
          Setup                  Montage Type: Bip

    Imped. Cycle | 15 min
    Select Montage  Gen.
    EEG Channels    4
    Montage Type    Bip
          Cycle     Manual
    Stim. Frequency 8.1 Hz
    Stim. Intensity 40 dB                      0
       Previous Menu                           0
                                               0

                                               2
                                            m  0
                                            n  0
```

4.14   BIS

Service menu for BIS Module, E-BIS or M-BIS, for Bispectral index measurements.

Module service page

Check Sensor activates the sensor impedance check.

Module

Measurement indicates if BIS Engine is on: ON/OFF.

Imp. Check Key indicates that the key in the module front panel works properly.
Bis Menu Key indicates that the key in the module front panel works properly**.**

Impedance Meas indicates the impedance measurement mode. The modes are CYCLIC/COMBINED/GROUND/OFF.

BIS Engine errors: error messages created by DSC or BIS Engine. For a detailed description of the error message see Table 11 BIS Engine and DSC error messages**.**

Statuses (HEX): See APPENDIX A How to read HEX numbers**.**

```
   BIS          Measurement: ON              MODULE

Check Sensor     Imp. Check Key
                 Bis Menu Key
Module      ◄
                 Impedance Meas.   COMBINED
Sensor
                 BIS engine errors:
BIS Setup   ▤

Previous Menu



                 General_status1  0000
                 Bis_status1      17C8
                 Msgs to BE     56 Msgs from BE  20281

                 Mod Mon Timeouts            2
                 Mod Mon Bad Checksum        0
                 Mon Mod Bad Checksum        0
                 Bad Checksums from BIS      3

                 RAM     OK        BIS      623
                 ROM     OK        SQI     1000
                 EEPROM  OK        EMG     2610
                                   SR         0
```

General Status1 indicates the general status of the module. For a detailed description of the message see Table 9 Module general status.
Bis_status1 indicates the BIS Engine status. See Table 10 BIS Engine status for a detailed description of the message.
Msgs to BE number of data packages sent from the interface board to BIS Engine.
Msgs from BE number of data packages sent from BIS Engine to the interface board.

Mod Mon Timeouts is a cumulative number that indicates how many times the module (interface board) has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module (interface board) to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module (interface board).
Bad Checksums from BIS is a cumulative number that indicates how many times there has been an error in the message from the BIS Engine to the module interface board.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Measured parameters indicated:
BIS indicates BIS index; range 0...1000 (corresponds to 0...100)
SQI indicates signal quality index; range 0...1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0...10000 (corresponds to 0...100dB NOTE! On the display, EMG will be shown between 30...55dB on the bar graph or 30...80dB on the trend)
SR indicates supression ratio; range 0...100 (corresponds to 0...100%)
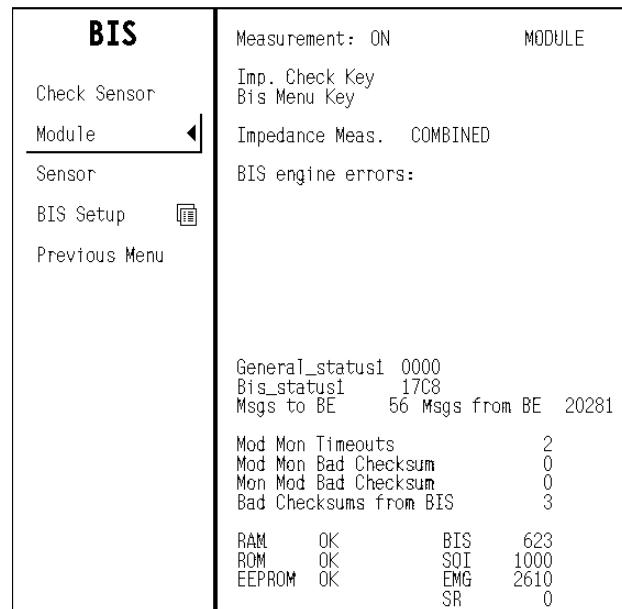
General_Status1 Module general status

Table 9   Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

BIS_Status1 BIS Engine status

Table 10   BIS Engine status

bit 0	Check Sensor key pressed
bit 1	BIS key pressed
bit 2	Inpedance check mode cyclic
bit 3	Impedance check mode combined
bit 4	Impedance check mode ground
bit 5	Impedance check off
bit 6	Measurement on
bit 7	EEG measurement on
bit 8	Impedance check on DSC channel 1 passed
bit 9	Impedance check on DSC channel 2 passed
bit 10	BIS Engine powerup failure
bit 11	DSC selftest failure
bit 12	DSC quick test failure
bit 13	DSC selftest on
bit 14	No data from BIS Engine
bit 15	Not used

Table 11   BIS Engine and DSC error messages

Message	Errors of type 2
Illegal message ID	Errors for layer 3 packets
Illegal command parameter	
Illegal length for layer 2 data	
Disabled interrupt received - UART transmitter empty interrupt	UART related errors
Disabled interrupt received - UART modem interrupt	
No status nibble received	DSC related errors
DSC not connected	
DSC disconnected after test failure	
Illegal DSC ID	
DSC power regulation fault	
DSC interface fault	
DSC did not respond to command	
Illegal PIC ID	
DSC overcurrent	
DSC overrun	
EEPROM Bad packet length	Software update related errors
EEPROM Bad checksum	
EEPROM Bad code length	
EEPROM Illegal packet subtype	
EEPROM physical write error	
EEPROM NOT_DATA_TIMEOUT	

4.14.1 Sensor

Sensor type: indicates the type of the sensor connected.
Lot code: indicates the manufacturing lot code of the sensor. The lot code contains the manufacturing date and shift.
Serial no: indicates the serial number of the sensor.
Shelf life: indicates max storage duration.
Usage count: indicates how many times the sensor has been attached/detached. Not in use.

Mains Freq.: indicates the set mains frequency; 50Hz/60 Hz.

Sensor Impedances: indicates the last measured impedances.
Imped. indicates the measured impedance value in Kohms.
Qualif. indicates the quality of the measured impedance; PASS/FAIL.

```
  BIS                                    SENSOR

Check Sensor        Sensor type: Demo sensor
                    Lot code:    0911021L
Module              Serial no:   00069
                    Shelf life:  12 months
Sensor         ◀    Usage count: 0

BIS Setup      ▦    Mains Freq. 50 Hz

Previous Menu       Sensor  Imped. Qualif.
                      1        6    PASS
                      2       24    PASS
                      3        4    PASS
                      4

                    BE powerup test:   PASS
                    DSC selftest ch1:  PASS
                    DSC selftest ch2:  PASS

                    BIS        690
                    SQI        825
                    EMG       2629
                    SR           0


                    DSC status     0000 0000 0000 0000
                    Sensor status                   031
                    BE powup stat                  0000
```

BE powerup test: indicates the status of BIS Engine power up test: PASS/FAIL.
DSC selftest ch1: indicates the DSC selftest status for channel 1: PASS/FAIL.
DSC selftest ch2: indicates the DSC selftest status for channel 2: PASS/FAIL.

Measured parameters indicated:
BIS indicates BIS index; range 0..1000 (corresponds to 0..100)
SQI indicates signal quality index; range 0..1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0..10000 (corresponds to 0..100dB)
(NOTE! On the trend display, EMG will be shown between 30..80dB)
SR indicates supression ratio; range 0...100 (corresponds to 0..100%)

Statuses (HEX): See APPENDIX A How to read HEX numbers.
DSC status: indicates the DSC status for the four channels. See Table 12 DSC status for a detailed description of the message.
Sensor status: indicates the Sensor status. See Table 13 Sensor status for a detailed description of the message.
BE powup stat: indicates the BE power up status. See Table 14 BE power up status for a detailed description of the message.

Table 12   DSC status

bit 0	Noise test
bit 1	BIS key pressed
bit 2	Blocked droop test
bit 3	Unblocked gain test
bit 4	Impedance wait time out test
bit 5	Noise timeout test
bit 6	Blocked timeout test
bit 7	Unblocked timeout test
bit 8	DSC not connected test
bit 9	Not used test
bit 10	Not used test
bits 11 - 15	Not used

Table 13   Sensor status

bit 0	Quick selftest pass
bit 1	Quick selftest gain
bit 2	Quick selftest noise
bit 3	Quick selftest fail
bit 4	Quick selftest valid
bit 5	Sensor valid
bit 6	Sensor invalid
bit 7	Sensor too many uses
bit 8	Sensor expired
bit 9	Sensor validity unknown
bits 10 -15	Not used

Table 14   BE power up status

bit 0	XRAM test
bit 1	Dma test
bit 2	Timer test
bit 3	Fpga test
bits 4 -15	Not used

4.14.2 BIS Setup

Automatic Check: A selection to define whether the automatic sensor check is used ON/OFF.

Test DSC indicates the status of the DSC self test; PASS/FAIL.

Filters: A selection to define if filters are used
ON; disturbances are filtered from the raw EEG signal
OFF; raw EEG signal is shown.

```
 BIS                              SENSOR

    BIS Setup                   ensor
 Automatic Check │ ON           1L
     Test DSC   PASS            ths
     Filters    ON
  Previous Menu                 if.


                               PASS
                               PASS
                               PASS



 Set automatic sensor checking
 ON or OFF.      ─────        0 0000 0000 0000
                                         031
                                        0000
```
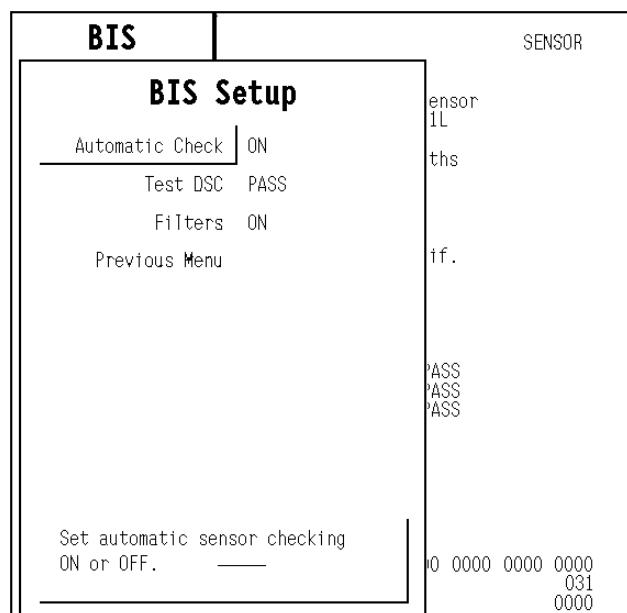
4.15 Entropy

Check Sensor Module measures the impedance of sensor electrodes. Works the same way as from Entropy menu or module key.

Module Service data is changed to the module view.

Measurement shows whether the Entropy measurement is ON or OFF. Measurement should start by itself when the sensor is attached to the patient.

Last service shows the date of last maintenance.

Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Mains shows the currently used mains frequency, 50 or 60 Hz:

```
 Entropy           Measurement:   ON
                   Last Service:
Check Sensor
                   Entropy
Module        ◄    Check Sensor
Sensor
Previous Menu

                   Mains         50 Hz
                   BSR status    Suppression
                   Artefact      Off
                   Diathermy     Off
                   AD clipped    Off

                   Alg. ver. (Mon)       0
                   Alg. ver. (Mod)       1
                   Alg. ver. used

                   Timeouts              2
                   Mod Mon Bad Checksum  0
                   Mon Mod Bad Checksum  0

                   RAM     OK
                   ROM     OK
                   EEPROM  OK
```

BSR Status shows Burst if the module is not currently detecting suppressed EEG. Shows Suppression if the module is detecting suppressed EEG periods.

Artefact shows Off, if there is no high-frequency noise present, On if the module detects noise.

Diathermy shows On, if the module is detecting diathermy (i.e., electrocautery).

AD clipped shows On, if the signal is getting clipped at the A/D converter.

Alg. ver. (Mon) shows the monitor algorithm version number.
Alg. ver. (Mod) shows the module algorithm version number.
Alg. ver. used shows the currently used algorithm version.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid. The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

4.15.1 Sensor

Sensor Service data is changed to the sensor view.

Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Cable indicates whether the Entropy sensor cable is connected to the module or not.

Sensor indicates whether the Entropy sensor is connected to the cable or not.

Sensor S/N module reads the manufacturing serial number from the sensor chip.

Sensor Lot module reads the manufacturing lot number from the sensor chip.

```
┌─────────────────────────────────────────────┐
│  Entropy    │  Entropy                       │
│             │  Check Sensor                  │
│ Check Sensor│                                │
│             │  Cable      On                 │
│ Module      │  Sensor     On                 │
│             │  Sensor S/N  N/A   Sensor Lot --/--/-- │
│ Sensor    ◀ │                                │
│             │             1    2    3         │
│ Previous Menu│                               │
│             │  Lead      On   On   On         │
│             │                                │
│             │  Imped.   0.0  0.0  0.0   kOhm  │
│             │                                │
│             │                                │
│             │  Imp. Meas.    Off             │
│             │  Imp. Check    OK              │
└─────────────────────────────────────────────┘
```

Lead 1/2/3 shows the lead on/off status of all sensor electrodes.

Imped. 1/2/3 shows the respective impedance value of each sensor electrode of the last impedance check.

Imp. Meas. shows On if the Automatic check (sensor impedance measurement) is on in the module.

Imp. Check shows OK if the last impedance check has been successful.

4.16 DIS Interfacing

4.16.1 Interfacing

```
        Monitor Setup                      Monitor Setup
                                             Interfacing
     Screen 1 Setup  ▤
     Screen 2 Setup  ▤                 Gases │ Module
      Sweep Speeds   ▤             Spirometry  Datex
       Select Mode   ▤                   NIBP  Module
      Time and Date  ▤                   SpO2  Module
       Interfacing │ ▤                   C.O.  Module
     Install/Service  ▤                  SvO2  Module
       Normal Screen                     PgCO2  Module
                                          BIS  Module
                                    Status Page  ▤
                                    Previous Menu
     Make permanent changes and
     changes to modes.             Select gases from module or
     Show Service menus.           external monitor.
```

How to interface

To select the parameter data source:

- Press the **Monitor Setup** and select *Interfacing*.

- Select the desired measurement parameter, for example *Gases*.

- Select the desired source by name, for example *Aest*.

NOTE: The name of the device is visible on the list only if the device is correctly connected to the module.

4.16.2 Status Page

Access via **Monitor setup -** *Interfacing.*

The selection **Next page** is available, if more than 8 DIS modules are connected to the DIS bus simultaneously.

Interfaces

The menu displays a list of all connected DIS modules and the statuses of the corresponding external devices.

If the bus voltage is too low, you cannot add more devices. 'DIS module bus voltage low. Do not add more devices or reduce cable length' message appears.

```
Status Page          Interfaces
                   -White Line Monitors
Next Page            Device connected

Previous Menu




Return to
previous menu.
```
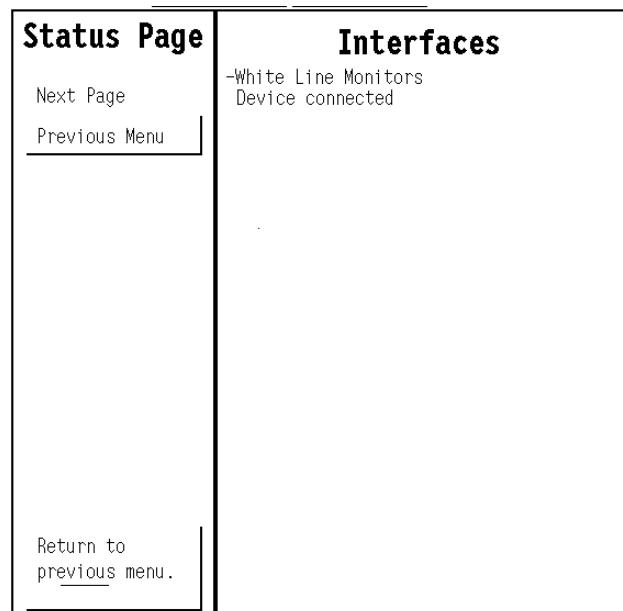
4.16.3 DIS Interfacing

DIS Interfacing

The menu displays submenus for all connected DIS modules.

```
              More...
          DIS Interfacing

         Previous Menu




       Return to previous menu.
       There are not connected
       interface boxes.
```
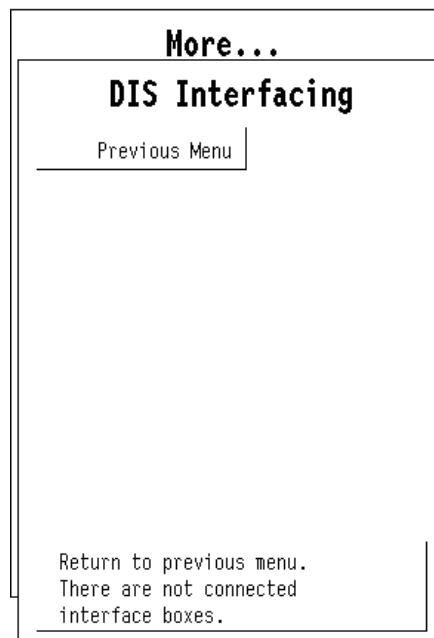
DIS Module specific page

Service Data

Product name: DIS module name.
Product type: DIS module type.
Driver sw id: DIS module software and its release date.
Short product name: DIS module name.
Module serial number: DIS module serial number.
HW card type: PCB type.
HW id: DIS module PCB identification number.
HW test date: DIS module PCB testing date.
Unit serial number: DIS module PCB serial number.

Comment field: Indicates the status of the external device.

bus voltage: DIS bus voltage, measured by the Central Processing Board in S/5 Compact Monitor. The value should normally be within 6...8 V.

```
DIS Module        Service Data
                Product name   Baxter Vigilance
Previous Menu   Product type   N-DISVIG
                Driver sw id   8001734-1.0 2001-05-22
                Short product name   Vigil
                Module serial number 4546967
                HW card type         DIS
                HW id                8000272-002
                HW test date         2001-09-25
                Unit serial number   0525921569

                external device is connected

                bus voltage     7.93 V  NORMAL

                module to monitor communication
                tout:2     cse:  0
                external device communication packets
                rx:487     rx err: 0      tx: 0

                required serial communication settings
                bit rate 19200, 8 data bits
                 parity none, 1 stop bit

                Ram OK      Rom OK     EEPROM  OK
```

tout: DIS module timeouts, seen by the monitor. The value should not increase more than by 5 per second.
cse: DIS module checksum errors, seen by the monitor. The value should not increase more than by 5 per second.
rx: The number of data packets from the external device received by the DIS module.
rx err: The number of data errors from the external device received by the DIS module.
tx: The number of data packets to the external device sent by the DIS module.

Ram: Status of DIS module RAM memory.
Rom: Status of DIS module ROM memory.
EEPROM: Status of DIS module EEPROM memory.

5 Set/Test

In the power supply unit, there is a safety element, which needs refreshing at least every 1.5 seconds. If the main CPU's software will not refresh, safety element gives reset to main CPU. In normal operation the main CPU's software refreshes safety element every 0.2 seconds.

The purpose of the safety element is to restart the monitor if there is a serious malfunction. This feature is useful in two cases: when the main CPU's software is not able to control the monitor, and when the software controls the monitor but detects a serious malfunction.

Watchdog tests ensure the proper functionality of the safety element's various sections.Watchdog test ensures directly that the watchdog of the power unit functions properly. Choosing this test prevents safety element from refreshing and shows running seconds with an accuracy of 0.1 seconds.

```
┌────────────────┬──────────────────────┐
│Service Menu│ Sw version / Unit id    │
│  ┌──────────────┐                      │
│  │  Set / Test  │                      │
│  │              │ ───────────────      │
│  │  Watchdog  │ │ L005168-16.0         │
│  │ WD by Overload│                     │
│  │  WD by UPI   │ ───────────────      │
│  │  WD by GSP   │ L-05-24              │
│  │ Factory Reset│ ───────────────      │
│  │Country Settings 📖│ e: level: ───── │
│  │ Previous Menu│ )                    │
│  │              │ ───────────────      │
│  │              │ ───────────────      │
│  │              │ ───────────────      │
│  │              │ ───────────────      │
│  │              │        -More-        │
│  └──────────────┘                      │
└────────────────┴──────────────────────┘
```

The test should have the following result when the safety element is working properly: The monitor will restart after 1.5 seconds from the start of the test. In malfunction: '>20 s' is displayed, and the test will interrupt. In this case, the fault is in the safety element of the power unit.

WD by Overload test ensures the functionality of a feature, where the software controls the monitor, but detects an overload situation in the main CPU.

The test should have the following result when the feature is working properly: The monitor will restart after 15 seconds from the start of the test.

WD by UPI test ensures the functionality of a feature, where the software controls the monitor, but detects amalfunction at the UPI section. The test will prevent the UPI processor from functioning during the test.

Immediately after the test starts the plotting stops. The test should have the following result when the feature is working properly: The monitor will restart the UPI section without any visual effects.

WD by GSP ensures the functionality of a feature, where the software controls the monitor, but detects a malfunction at the GSP section. The test will prevent GSP processor from functioning during the test.

The test should have the following result when the feature is working properly: The monitor will restart the GSP section without any visual effects.

Factory Reset restore factory default settings and clear data memories. Factory reset should be run if monitor software is replaced or if the SRAM/Timekeeper IC, or its battery is replaced.
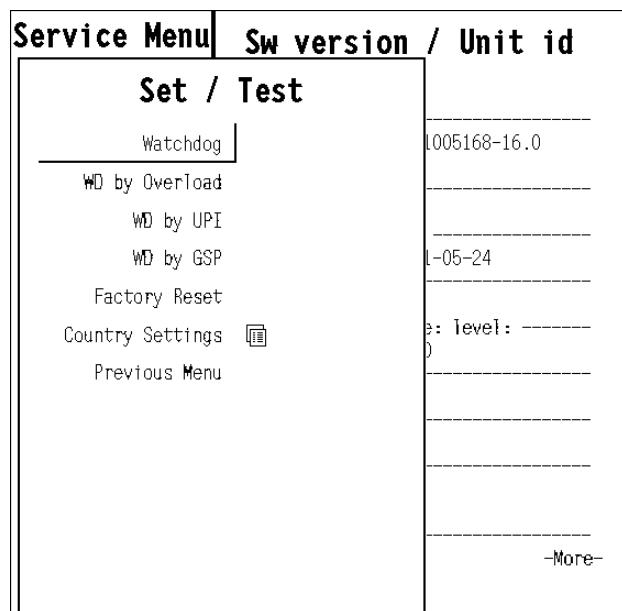
5.1   Country Settings

Language

Select the software language.

National Reqs

Select the software features, which include national requirements.

Power Frequency

Set the power frequency (50 Hz/60 Hz). This setting is used to filter out possible power frequency interference from the parameter measurements.

Time format

Set the time format of the real time clock (24 h/12 h).

```
           Set / Test
         Country Settings
        Language  │ Eng.
     National Reqs   None
    Power Frequency  50 Hz
      Time Format   24  h
      Previous Menu




    Change language translation of
    screen texts.
```
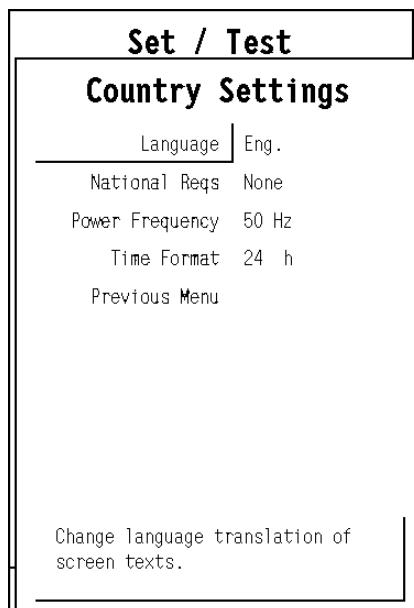
6   Service Log

Error, event, alarm and maintenance data is stored in Service Log.

The service log contains information about the occurred monitor errors, events and alarms since the last factory reset or service log reset. The service log is saved in the EEPROM memory of the main CPU board. The user can also store different maintenance events in the maintenance log.

Maintenance menu is for setting and viewing the maintenance information of the monitor.

Error History is for selecting the error history view onto the right side of the menu.

Event History is for selecting the event history view onto the right side of the menu.

Alarm History is for selecting the alarm history view onto the right side of the menu.

Scroll Last Er (Ev) is for scrolling the error / event / alarm information on the right side of the menu.

Scroll Counters is for scrolling the error / event / alarm counters on the right side of the menu.

Record Data is for recording the service log information onto the recorder.

Reset Log is for clearing up the content of the service log. This function should be run after a performed maintenance. In Error/Event history view, the Reset Log command clears up both the error and the event log. In the Alarm History view, the Reset Log command resets only the alarm history log.

```
┌───────────────┬──────────────────────────────┐
│ Service Log   │       Error History          │
│               │ Last errors:                 │
│ Maintenance ▣ │                              │
│ Error History │  DIS module disconnected     │
│ Event History │            2004-Apr-26 13:50:08 │
│ Alarm History │                              │
│ Scroll Last Er│                              │
│ Scroll Countrs│                              │
│ Record Data   │  Error counters:             │
│ Reset Log     │                              │
│ Previous Menu │                              │
│               │                              │
│               │                              │
│               │ Last log reset:  2004-Apr-21 09:19:34 │
└───────────────┴──────────────────────────────┘
```

6.1   Maintenance

The Maintenance History Log gives the user a possibility to store the maintenance history of the monitor. The user can store different planned maintenance (PM) events, repairs and upgrades in the maintenance history log.

Running hours: shows how many hours the monitor has been on. User cannot reset this value.

since This date and time is set at the factory and it shows the manufacturing date and time. User cannot reset this date and time.

since last 1 year PM: shows the running hours since the last 1 year PM storing.

Last events: The section shows the last maintenance events and the time of their occurrence.

Event counters: The section contains counters for each different maintenance events. The time of occurrence of the last event is shown beside each counter.

```
Maintenance │  Maintenance History
            │ Running hours:   791
Plan. Maint │ since            2001-Jun-20 09:43:00
            │ since last 1 Year PM:    0
Repair      │
            │
Upgrade     │
            │ Last events:
Remove Last Ev │
            │
Scroll Last Ev │
            │
Scroll Countrs │
            │
Record Data │
            │
Previous Menu │
            │ Event counters:
            │
```

6.1.1   Planned Maintenance

1 Year PM gives you the possibility to store a 1 year PM event in the maintenance history log.

Other PM gives you the possibility to store another PM event in the maintenance history log.

Notify on PM This feature is for future purposes.

```
Maintenance │   Maintenance History
┌──────────────────────────────┐
│ Planned Maintenance   01-Jun-20 09:43:00
│                              0
│        1 Year PM │
│        Other PM
│     Notify on PM   No
│     Previous Menu
│
│
│
│
│
│   Save 1 year PM to maintenance
│   history.
└──────────────────────────────┘
```

6.1.2 Repair

The repair menu gives the user a possibility to store re-pair events in the maintenance history log. The different repairs that can be saved are: **Display, Power Supply, Recorder, Frame** (e.g. board in the frame), **Parameters** (e.g. a board in the parameter module) or **Other** (a miscellaneous repair not specified by previous options).

```
Maintenance |    Maintenance History
          ┌──────────────────────┐
          │      Repair          │  01-Jun-20 09:43:00
          │ ┌─────────┐          │         0
          │ │ Display │          │
          │ └─────────┘          │
          │   Power Supply       │
          │     Recorder         │
          │       Frame          │
          │    Parameters        │
          │       Other          │
          │   Previous Menu      │
          │                      │
          │                      │
          │                      │
          │ Save repair of Display to │
          │ maintenance history. │
          └──────────────────────┘
```
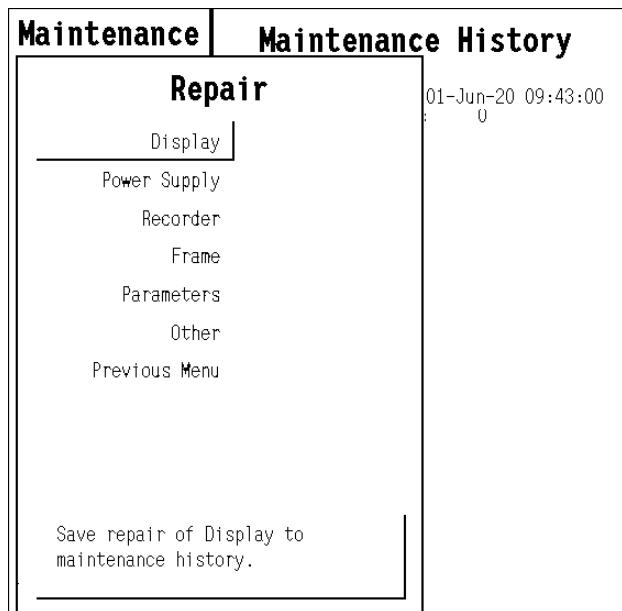
6.1.3 Upgrade

The upgrade menu gives the user a possibility to store the upgrades in the maintenance history log.

```
Maintenance |   Maintenance History
          ┌──────────────────────┐
          │     Upgrade          │  01-Jun-20 09:43:00
          │ ┌─────────┐          │         0
          │ │ Upgrade │          │
          │ └─────────┘          │
          │   Previous Menu      │
          │                      │
          │                      │
          │                      │
          │                      │
          │                      │
          │                      │
          │ Save upgrade to maintenance │
          │ history.             │
          └──────────────────────┘
```
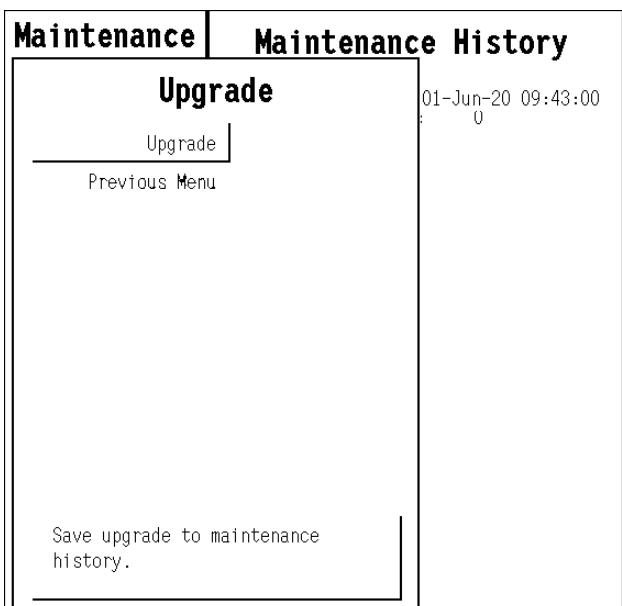
6.2   Error History

Last Errors: The section shows the last monitor errors and the time of their occurence.

Error counters: The section contains counters for each different (detected) monitor error. The time of occurrence of the last error is shown beside each counter.

Last log reset: The date and time of the last Error/Event log reset.

Possible errors:

Fast cold start indicates the number of erroneous cold starts with power off time less than 20 seconds. The reason can be either a failing lead acid battery or a software problem that was solved by the hardware watchdog circuitry located in the monitor's power supply unit.

GSP watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the display controller board. The restart is listed as a fast cold start.

UPI watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the UPI section. The restart is listed as a fast cold start.

```
Service Log        Error History

Maintenance     📖   Last errors:

Error History         DIS module disconnected
                                2004-Apr-26 13:50:08
Event History

Alarm History

Scroll Last Er

Scroll Countrs

Record Data        Error counters:

Reset Log

Previous Menu




                   Last log reset:   2004-Apr-21 09:19:34
```

6.3   Event History

Last events: The section shows the last events and the time of their occurrence.

Event counters: The section contains counters for each different (detected) event. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last Error/Event log reset.

Possible events:

Cold start is a start-up with power off time more than 15 minutes. The trend memory is cleared and monitoring starts with the user default settings.

Warm start is a start-up with power off time less than 15 minutes. The trend information and possible temporary settings are still available.

```
Service Log        Event History

Maintenance     📖   Last events:

Error History
                      Time set by network (2 s)
Event History                   2004-May-04 14:12:42
                      Time set by network (6 s)
Alarm History                   2004-May-04 09:22:42
                      Time set by network (6 s)
Scroll Last Ev                  2004-Apr-30 09:22:11

Scroll Countrs     Event counters:

Record Data
                      Cold start
Reset Log               Count 1 last 1995-Jan-01 08:01:02
                   Warm start 26 s
Previous Menu           Count 3 last 2004-Apr-21 10:26:20




                   Last log reset:   2004-Apr-21 09:19:34
```

6.4   Alarm History

Last alarms: The section shows the last events and the time of their occurrence.

Alarm counters: The section contains counters for each different (detected) event. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last alarm log reset.

```
Service Log │        Alarm History
            │ Last alarms:
Maintenance ▤│
Error History│
Event History│
Alarm History│
Scroll Last Al│
Scroll Countrs│
Record Data  │ Alarm counters:
Reset Log    │
Previous Menu │
            │
            │
            │
            │ Last log reset:    2004-May-18 12:13:22
```

7   Record Data

In this menu, the user can specify where to print from any service menu. The setting goes into the permanent memory of the monitor. Only one option can be chosen at a time. The options where to print are: **To Printer, To Recorder** and **To Memory Card**. Only the option **To Recorder** can be selected.

```
Service Menu│ Sw version / Unit id
      Record Data
     To Printer              ──────────────
    To Recorder │ Active    L005168-16.0
   To Memory Card            ──────────────
    Previous Menu            L-05-24
                             ──────────────
                            e: level: ───────
                            )
                             ──────────────
                             ──────────────
                             ──────────────
    Output all service page  ──────────────
    recordings to recorder.          -More-
```
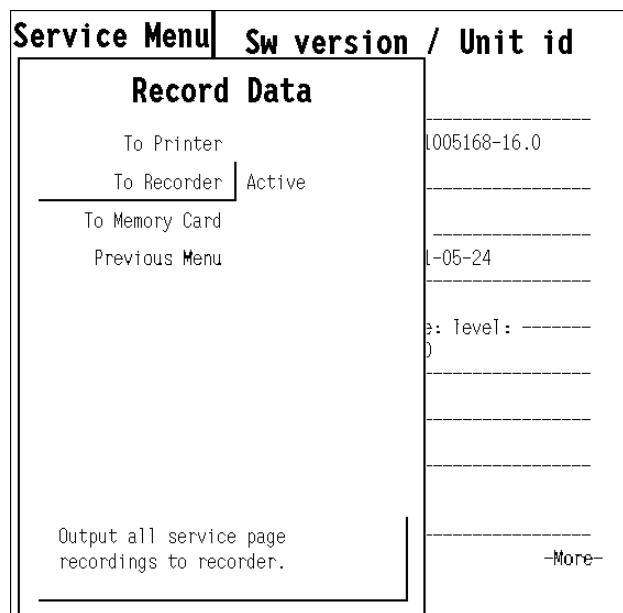
8   Remote Access

Remote Access menu is for setting the interface with an external PC that runs the Virtual Support software, which is a service diagnostic tool for remote diagnostics purposes.

When the access mode is set to **Normal** (the default), the PC can only read service menu data from the monitor. With the access mode **Extended,** the PC can also activate the monitor's service menu functions.

NOTE: Patient monitoring is not possible, when the access mode Extended is selected. The access mode turns back to Normal, if the monitor is restarted or if the service menu is closed.

```
Service Menu   Sw version / Unit id
      Remote Access
                                   _____
     Access Mode │ Normal          l005168-16.0
      Previous Menu
                                   _____

                                   _____
                                   l-05-24
                                   _____

                                   e: level: -------
                                   )
                                   _____

                                   _____

                                   _____

      Select access mode for
      remote operations.          _____
                                              -More-
```
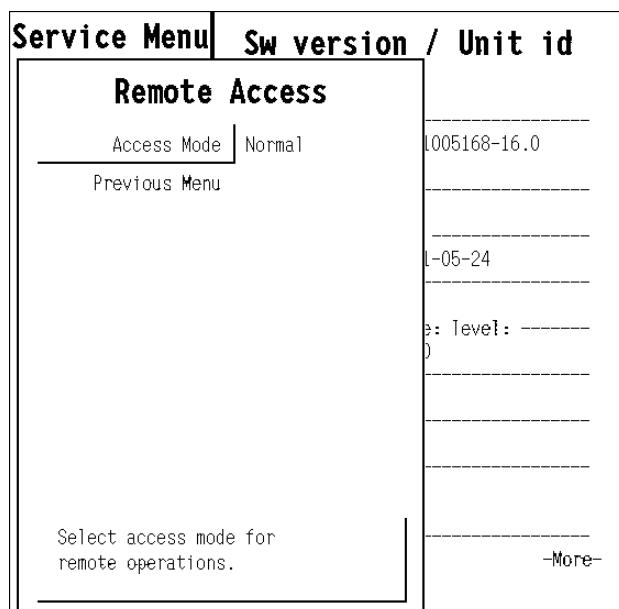
APPENDIX A   How to read HEX numbers

Some statuses on BIS and Tonometry Module service pages are given as HEX (hexadecimal) numbers. To understand them, please read the following:

A HEX number has a base of 16 instead of 10. This means that every character in a number can have a value between 0 and 15. Numbers from 0 to 9 are displayed as if they were normal 10-based numbers. Numbers from 10 to 15 are displayed with letters from a to f or A to F respectively.

Every character of a HEX number expands into a binary code of four 0:s (zeroes) and 1:s (ones) as given in table 9. Four successive characters thus expand into four times four binary numbers. Here's an example:

We have a HEX number F3A1. We expand the number into a binary code so that we first take the four binary digits that correspond to F, which are 1111. Then we write the four binaries that correspond to 3 (0011) after the first four. We now have 11110011. And so on.

Eventually, we have a string of 16 binary numbers, so called bits. HEX number F3A1 corresponds to a binary code of 1111 0011 1010 0001. Spaces are added here for legibility and to visualize the fact that every group of four bits corresponds to one HEX character.

The bits in a binary number are numbered from right to left always starting from 0 as follows:

bit 15	bit 14	bit 13	bit 12		bit 11	bit 10	bit 9	bit 8		bit 7	bit 6	bit 5	bit 4		bit 3	bit 2	bit 1	bit 0
1	1	1	1		0	0	1	1		1	0	1	0		0	0	0	1

With this information and the proper table of status fields you can translate a HEX status code into actual status messages. For the tables of status fields see section "Tonometry" or "BIS" . If a bit is 1, this means that the corresponding status/error condition is valid, whereas a 0 means that it is not.

Table 15   HEX to binary conversion

HEX	binary	HEX	binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

Datex-Ohmeda

S/5^{TM} Compact Anesthesia Monitor, F-CM1 (Rev. 04), F-CMREC1 (Rev. 01); Display Unit

S/5^{TM} Compact Critical Care Monitor, F-CMC1 (Rev. 04), F-CMCREC1 (Rev.01); Display Unit

Software License, L-CANE05/A
Software License, L-CICU05/A

Technical Reference Manual

All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.

Outside the USA, check local laws for any restriction that may apply.

Table of contents

Table of figures

Introduction

This section provides information about the maintenance and service of the following products:

- S/5™ Compact Anesthesia Monitor F-CM1 Display Unit and S/5™ Compact Critical Care Monitor F-CMC1, Display Unit (including UPI function, LCD display, Command board function, Display Controller function, NET function, MEM function, DIS function, Display Unit power supply unit) or S/5™ Compact Anesthesia Monitor F-CMREC1 Display Unit and S/5™ Compact Critical Care Monitor F-CMREC1 Display Unit (in addition to above mentioned parts also a built-in recorder).

- Software Licenses L-CANE05/A, L-CICU05/A.

All the service menus related to the monitor are described in a separate "Service Menu" slot and the spare part lists in "Compact Monitors Spare Parts" slot.
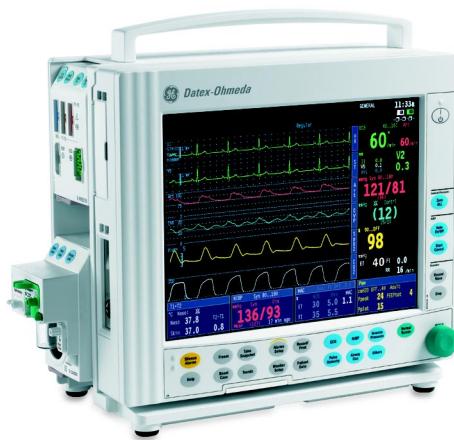
Figure 1   Compact Anesthesia Monitor

1   Specifications

1.1   S/5 Compact Monitor, F-CM1, F-CMREC1, F-CMC1, F-CMCREC1; Display Unit

Display Unit Dimensions, D x W x H	55 x 335 x 270 mm (2.2 x 13.2 x 10.6 in)
Weight	<4 kg (9 lb.)
Electrical Requirements	
Power supply	10...17 VDC (supplied by Frame Unit VBUS voltage)
Stability	±10% of nominal voltage
Power consumption	27.5 VA, max. 2 A
Battery operation	up to 1.5 hour
Grounding	Hospital grade
Interruptibility	Data memory and alarm settings are saved up to 15 minutes after monitor standby
Environmental Requirements	
Operating temperature	10 - 35 °C / 50 - 95 °F
Storage temperature	-10 - 50 °C / 14 - 122 °F
Humidity	10-90% non-condensing

1.2   LCD Display

Display size	12.1 in (diagonal)
Display type	Active Matrix Color TFT LCD
Resolution	SVGA 800x600

1.3   MemCard option

MemCard capacity	6 MB minimum
Data storage capacity	2 days of continuous physiological data trends
Operating system	Datalight ROM-DOS
File system	MS-DOS compatible
MemCards	PCMCIA-ATA compatible memory cards

1.4   Network option

Meets IEEE802.3 specifications (10BASE-T)
Hospital grade approved data transformer
Coding element interface

1.5   Wireless LAN option

Frequency range	2.4 to 2.5 GHz
Output power	100 mW
Data rate	11 Mbps per channel (max.)

Data transmission	IEEE 802.11b compliant,
	Direct Sequence Spread Spectrum (DSSS)
Roaming	Automatic roaming between the Datex-Ohmeda Central's
	Access Points
Certificates	Wi-Fi certified
Encryption	Wired Equivalent Privacy (WEP) 40 and 128 bit
WLAN adapter	PC card type with antenna

1.6   Recorder option

Power consumption	3 W
Printer type	Thermal array
Print resolution	Vertical 8 dots/mm (200 dots/inch)
	Horizontal 32 dots/mm (800 dots/inch)
	at a speed of 25 mm/s and slower
Paper width	50 mm, printing width 48 mm
Traces	Selectable 1, 2, or 3 traces
Print speed	1, 6.25, 12.5, 25 mm/s

1.7   Digital outputs of Display Unit

Nurse call	Low State: 0-0.8V; High State: 2.8-5V
	Generated on red and yellow alarms
Defibrillation Synchronization	State 0: 0-0.8V; state 1: 2.8-5V
	Delay (max): 35 ms from R peak
	Signal active time 10 ms
Serial Output	Asynchronous
	Serial data interface, uses RS-232 standard
	Baud rate max 115.2 kbps
	Parity: None; Data bits: 8; Stop bit: 1

2   Display Unit functional description

The Compact Monitor Display Unit includes the following parts:

- Central Processing Board (CPB): includes Display Controller, UPI, CPU and optionally Network and MemCard functions
- Color LCD display and its backlight inverter
- Connector board
- Command board
- Display Unit DC/DC power supply
- Fan and loudspeaker
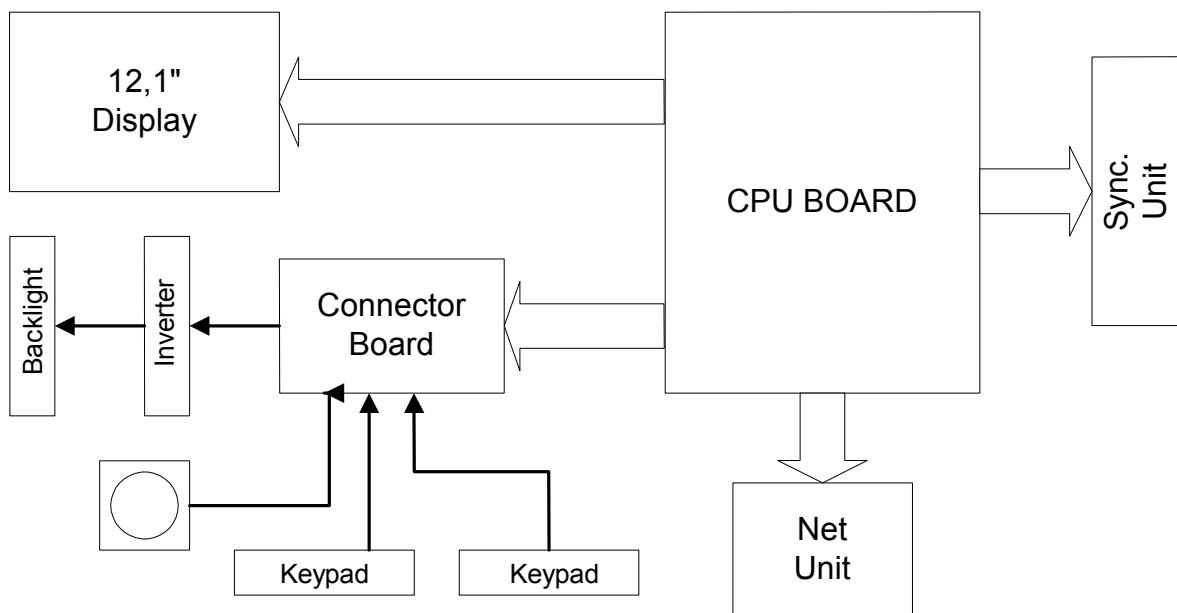
Figure 2   Basic structure of Display Unit

2.1   CPU section

The CPU section takes care of the central processing.

The main features are:

- 486 processor
- Internal clock frequency 100 MHz
- 32 Mbytes DRAM
- 8 Mbytes program flash memory
- 32 Kbytes static RAM with real time clock
- 4 channel UART:
    - 2 serial channels with signals in AC-logic level

- 2 serial channel signals in RS232-level
- Programmable alarm sound generator
- PC-card slot for software updates

2.1.1 Standby and Display Unit power down

When the monitor is turned to standby, NMI-interrupt is generated by the control logic. The interrupt signal in the Central Processing Board means that all the outputs from the CPB are switched off (i.e. display, alarm leds, etc.). The CPU section processor enters the HALT state.

During the Halt state the DRAM refreshing cycle continues to occur, thus saving trend and patient data and user settings stored in the DRAM. After 15 min. the Power Management Board (in the Frame Unit) cuts of the Display Unit voltage.

If the monitor is restarted within 15 min. of the last power off, a Warm Start is performed (trends and temporary settings will be available). If the monitor is restarted after 15 min. of the last power off, a Cold Start is performed (trends and temporary settings will be erased).

2.1.2 Watchdogs

There are certain watchdog functions to ensure the monitor's performance. The UPI interrupts the CPU continuously in order to tell that everything runs smoothly. If this watchdog fails, the UPI section is initialized. The monitor is not reset.

The CPU section has its own watchdog in order to ensure that the main software functions normally. In software overload situation the watchdog is not refreshed, and the monitor is reset.

The Central Processing Board (the CPU section) communicates with the Power Management Board in the Frame Unit. This communication is also used as a watchdog signal between CPB and PMB.
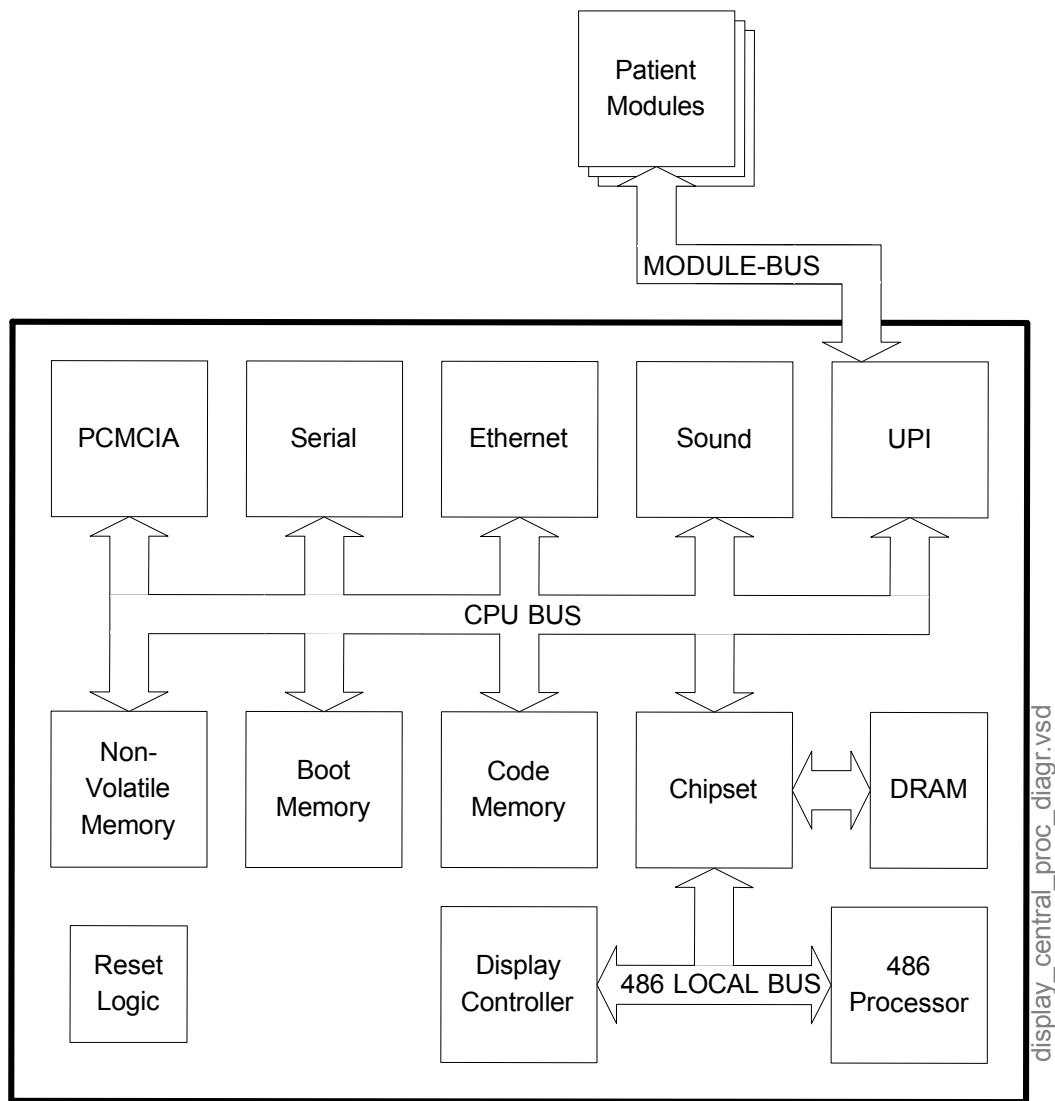
Figure 3   **Central Processing Board Block Diagram**

2.1.3   SRAM MT48T37V

The lithium battery back-up is a 32 Kbytes static RAM with a real-time clock.

CAUTION   The IC contains a lithium battery. Discard the battery according to local regulations.

2.2   UPI section

The UPI functions as a general I/O section. It performs I/O duties assigned to it by the CPU. The main processor and the processor on the UPI communicate through a dual-port memory (shared RAM) which is located on the UPI section.

2.2.1   Functional Blocks

The UPI section contains the CPU bus interface, a processor, program and dual-port memories, I/O block, and serial bus interface.

2.2.2   CPU Bus Interface

The UPI section is connected to the CPU section by CPU (ISA) bus. The following signals pass between the UPI and CPU: data bus, address bus, reset, write and read signals.

2.2.3   Processor

The processor of the UPI section is a Hitachi H8S/2655, which functions at 16 MHz frequency.

2.2.4   Serial Bus Interface

The serial bus interface of the UPI section contains Module Bus RS485, serial RS232 and RS422 interfaces.
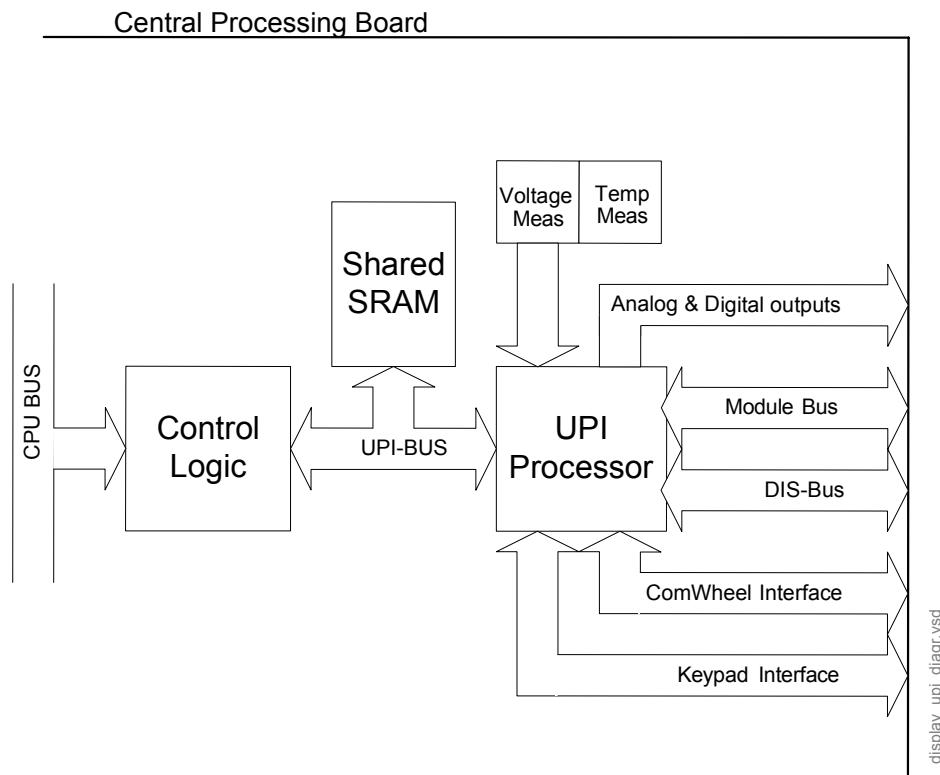
Figure 4   UPI Section Block Diagram

2.3   Software License, L-CANE05, L-CANE05A, L-CICU05, L-CICU05A

L-CICU05/L-CICU05A software is developed for critical care monitoring and L-CANE05/L-CANE05A is for anesthesia monitoring. Anesthesia record keeping capability is included in the anesthesia monitor software L-CANE05/L-CANE05A as standard. The software L-CANE05A and L-CICU05A include extended arrhythmia analysis.

L-CANE05/L-CANE05A/L-CICU05/L-CICU05A is a license software. The license agreement that is delivered with the software should be archived in a secure location. A relevant license number may have to be referred when contacting GE Healthcare service/support. The license number is needed also for future software upgrades.

Each of the above listed monitor software is loaded on a Central Processing Board at the factory, i.e. they are not available separately.

The L-xxx05(A)S software is used for service purposes only and is stored on a separate Software Card (PCMCIA, 8 MB). See section "Downloading the software on empty Central Processing Board".

The U-xxx05(A) software is used for upgrade purposes and is stored on a separate Software Card (PCMCIA, 8MB). See section "Downloading the software on empty Central Processing Board".

CAUTION   The software card is not write protected. For safety reasons do not use software cards for any other purpose, or on any other platforms than they are designed for.

2.4   Display controller section

The display controller is integrated to the Central Processing Board. The processor on the CPU section transmits graphics information through the CPU bus to the display memory on the Display Controller section.

The Display Controller section supports SVGA resolution. The resolution is automatically selected for the LCD display in use. The resolution is set to 800 x 600.

2.4.1   Display memory

The Display memory contains digital display data. The size of the memory is 1 Mbyte making an 800 x 600 display resolution with 256 colors possible. The memory consists of a 1Mbyte DRAM.

2.4.2   Display controller resolution

The resolution of the display controller is set to SVGA, i.e. 800x600 resolution.

Central Processing Board

DRAM
Memory

486 LOCAL-BUS

VGA
Controller

Flat Panel
Interface

display_contrllr_diagrm.vsd
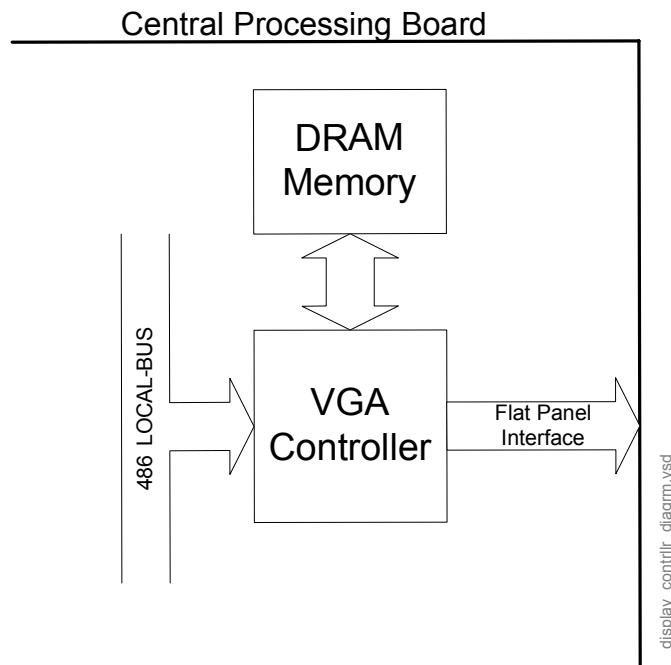
Figure 5   Display Controller Block Diagram

2.5   MEM section

2.5.1   Memory Card interface

The memory interface consists of a PD6722 controller and two PCMCIA compatible card sockets. Both sockets consist of 60 signal and 8 power connections. The controller communicates with the CPU. Card insertions and removal are also detected by the controller.

The MemCards are PCMCIA-ATA compatible. The MemCard files are MS-DOS compatible, and they can be copied for archiving with any MS-DOS compatible computer equipped with PCMCIA-ATA specification compatible card drive.

The MemCard function is optional. The operation requires a software option.

The monitor software can be downloaded to the monitor Flash memory through the memory interface.

2.5.2   Power supply

The memory section receives its power (+5V, +12V) from the CPB. PCMCIA card programming voltage is +12V. The card programming voltage is controlled by the interface controller.
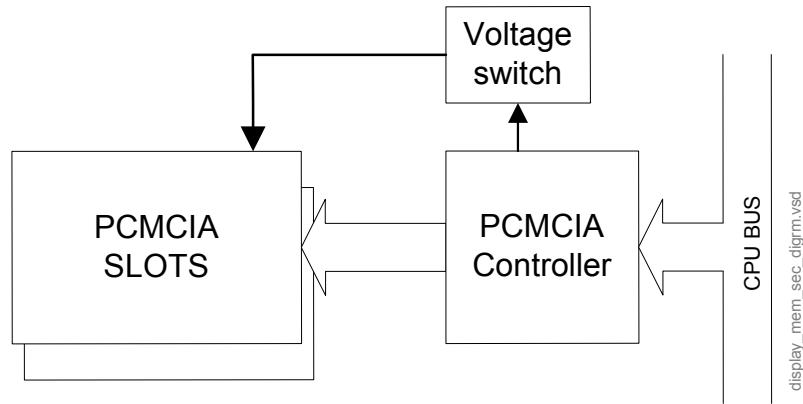
Figure 6   Memory Section Block Diagram

2.6   NET section

The Ethernet interface controller is basically the heart of the NET section. The interface controller communicates with the CPU section through the CPU bus. The section also contains a 4k SRAM memory.

The network interface controller transmits data packets to the Datex-Ohmeda Network and receives data packets from the network through the 10BASE-T transformer. The transformer filters and transforms the data and also provides the isolation.

The Ethernet status LEDs indicate the status of the network communication. The status LEDs are controlled by the network controller. The LEDs are located on the Central Processing Board.

The PLD interfaces the coding element. The coding element contains information on the monitor location. The network address and the monitor location information are transmitted to the CPU section directly through the CPU bus.

Central Processing Board

```
                    ┌──────────────┐
                    │    SRAM      │
                    │   Memory     │
                    └──────┬───────┘
                           ⇅
         CPU BUS    ┌──────────────┐
                    │   Ethernet   │  ⟺ 10BaseT
                    │  Controller  │
                    └──────┬───────┘
                           ⇅
                    ┌──────────────┐
                    │    Serial    │
                    │   EEPROM     │
                    └──────────────┘
         CPU BUS    ┌──────────────┐
                    │   ID-PLUG    │  ⟺ ID-PLUG
                    │  Interface   │
                    └──────────────┘
```

display_cntrl_proc_brd_digrm.vsd
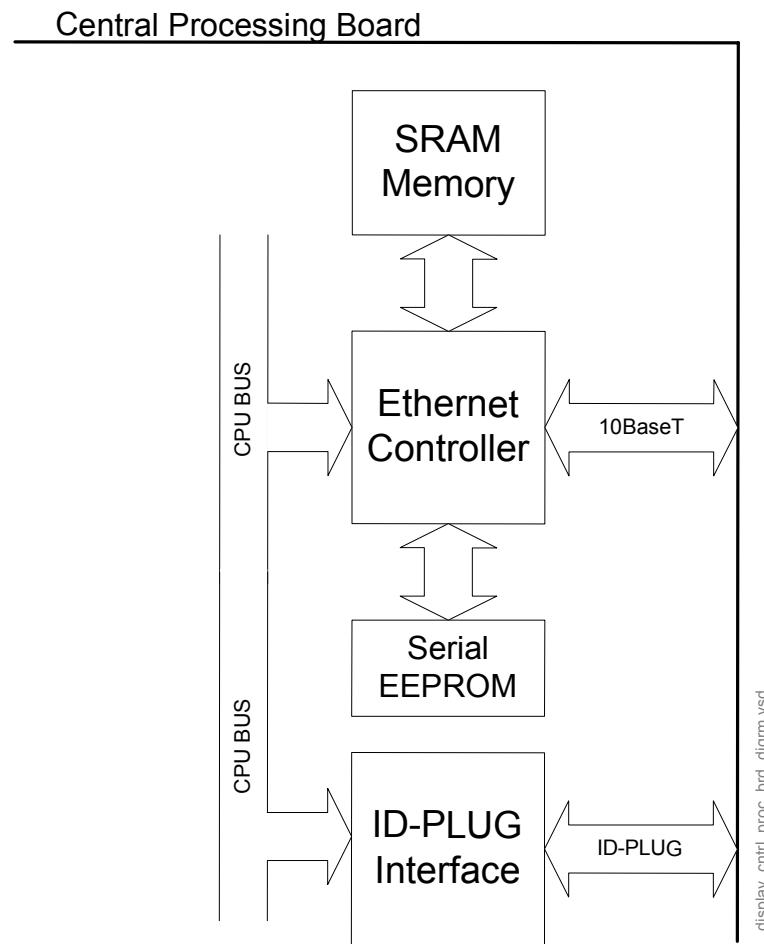
Figure 7   Central Processing Board, block diagram

2.6.1   Ethernet interface

The data transformer is designed by Datex-Ohmeda and it is hospital grade approved.

Adapter's 10BASE-T is an interface with low-pass filters on the unisolated side of the transformer. On the isolated side there is a common mode choke for both transmitting and receiving lines.

The three LEDs on the board, which are not seen from the outside, indicate the following things: activity on the network, collision detection and a good link in 10BASE-T interface.

The activity LED flashes when communication packets are detected in the Datex-Ohmeda Network. The collision detection LED indicates a packet collision on the network. The collision detection LED should flash only occasionally, otherwise there may be a physical layer problem. The good link LED indicates whether or not the communication link to the HUB is functional. The good link LED should always be lit.

2.7   Wireless LAN

Datex-Ohmeda Wireless Network is an extension to, or an alternative for, a wired Datex-Ohmeda Network. It provides same network services than the wired Datex-Ohmeda Network.

The monitor network is a local area network based on standard Ethernet technology. The monitor network is formed by connecting one Central and up to 32 bedside monitors together.

The Central and the bedside monitors are connected to a 10 Mbps hub. The hub works as a multiport repeater and controls the information flow between all the devices connected to the monitor network.

The communication protocol for the monitor network is Datex-Ohmeda specific.

Wireless bedside monitors can use both the wired and wireless network. If the network cable is connected, the wired Datex-Ohmeda Network is used.

For using Wireless LAN connection, the monitor requires Symbol24 Wireless LAN antenna card.

For configured parameters please refer to the Datex-Ohmeda Network, Wireless LAN Installation Guide.
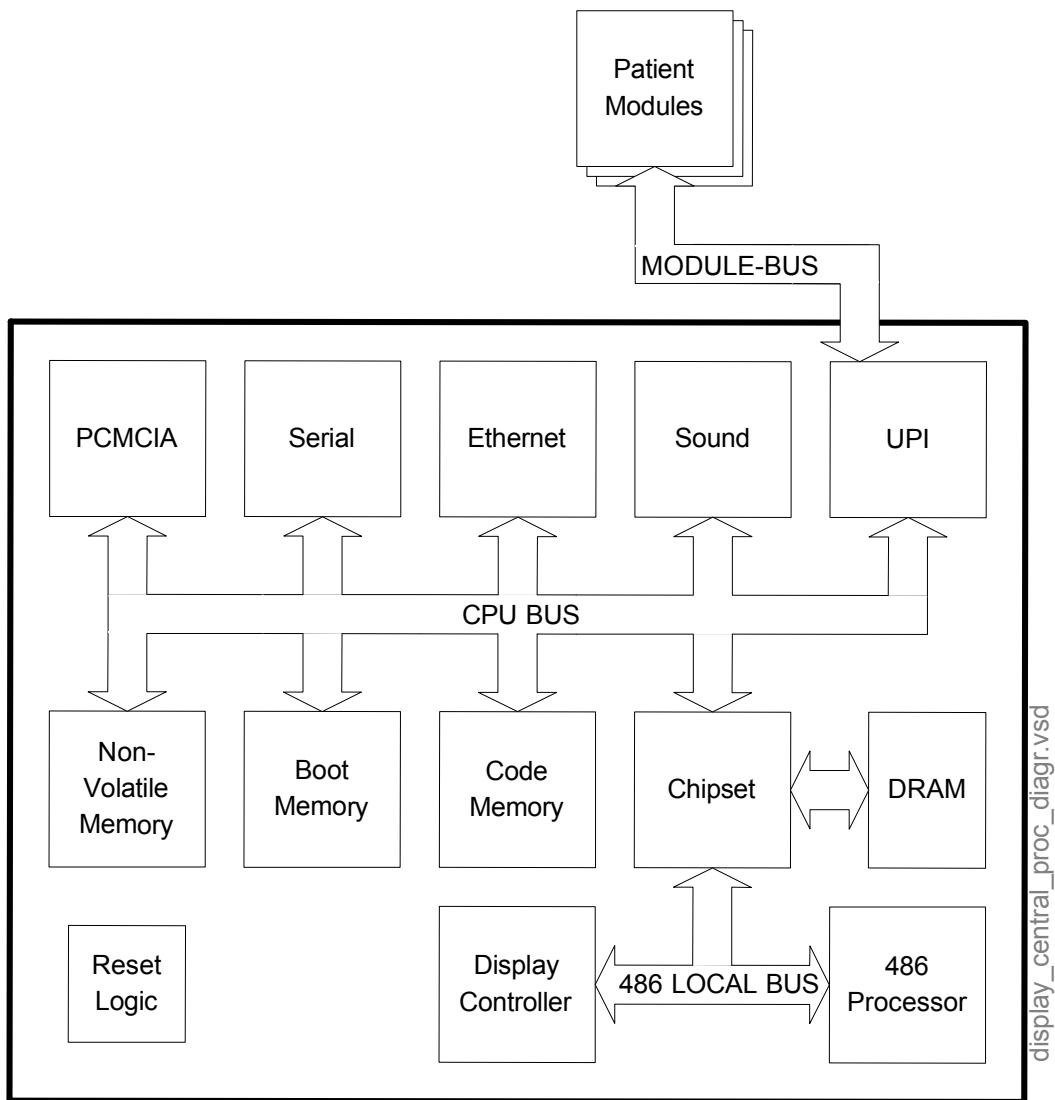
Figure 8   Central Processing Board parts

2.8   Front Unit

NOTE: The LCD display backlight circuit runs on a high voltage. Do not touch the inverter board or the backlight tube leads when powered.

Front Unit includes an LCD display component, Inverter Board, Connector board and Keyboard.

The Front Unit is connected to the Central Processing Board with two cables: video signal cable and Connector Board cable. The video signal cable transmits the video signal from the CPB to the LCD display. Video signalling between the Display Controller on the CPB and the Front Unit is analogic.

Backlight power, keyboard and ComWheel signals are routed through the Connector Board Cable.

2.8.1 Backlights

The backlight consists of two replaceable cold-cathode fluorescent tubes driven by a separate inverter board.

2.8.2 Connector board

The connector board is used for connecting the backlight power, keyboard and ComWheel signals between the Central Processing Board and the Front Unit.

2.8.3 Keyboard

There are two keyboards in the Display Unit Front Unit: front panel and side panel keyboards. The keyboards are foil membrane keypads. There is no separate processor for the keyboards. The keyboards are connected to the UPI section of the Central Processor Board through Connector Board.

2.9 Display Unit DC/DC power supply

This DC/DC converter board transforms primary voltage of between +10 and +18 VDC to +3.3V, +5V, and +12 V secondary voltages. All the output voltages have common ground.

The DC/DC power supply is powered by Vbus voltage generated by the Frame Unit AC/DC converter (mains). If the mains power fails, the DC/DC power supply is powered by batteries.

Turn-on and shut-down sequences of the DC/DC power supply are controlled by a logic on the DC/DC board and by the Central Processor Board software. If overvoltage occurs at an output line, the converter turns itself off automatically.

The Display Unit DC/DC converter supplies also a Display Unit fan.

2.10   Connectors and signals

2.10.1 External connectors
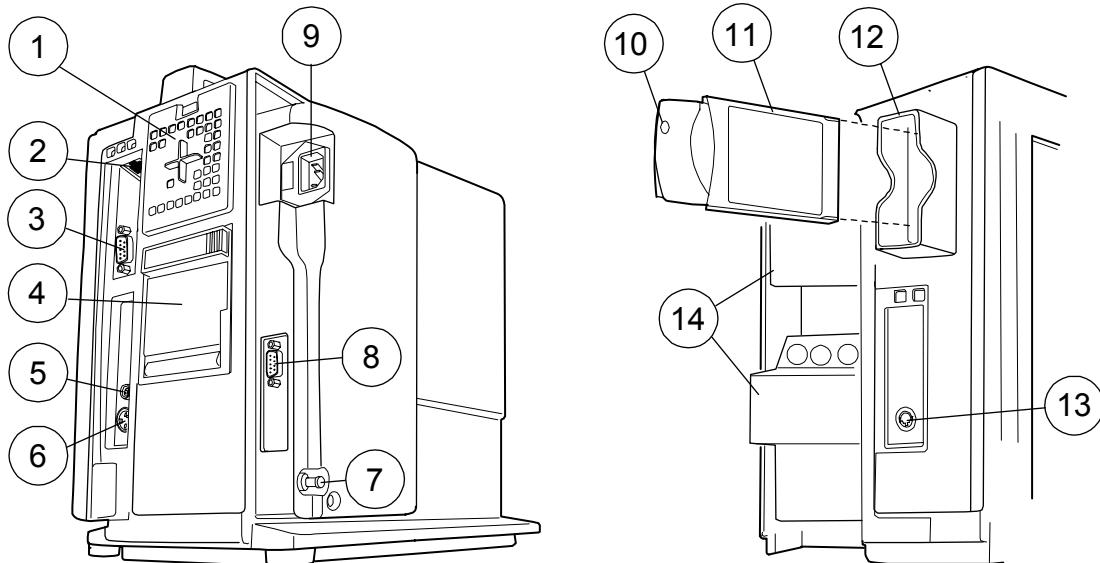
Figure 9   External connections of Compact Monitor frame F-CM(C)1 rev.04

(1)   Air filter

(2)   NET connector

(3)   NET ID connector (not used with N-CMW)

(4)   Recorder (optional)

(5)   SYNC connector

(6)   Connector for external keyboard (anesthesia record keeping solution keyboard), K-CREMCO or Barcode Reader

(7)   Potential equalization

(8)   Serial port

(9)   Receptacle for power cord

(10) WLAN PC card LED

(11) WLAN PC card

(12) Slot for Memory Cards (PCMCIA) and WLAN PC card

(13) Connector for Device Interfacing Solution

(14)   Modules

NOTE: Insert the WLAN PC card in the first PC card slot from the front.
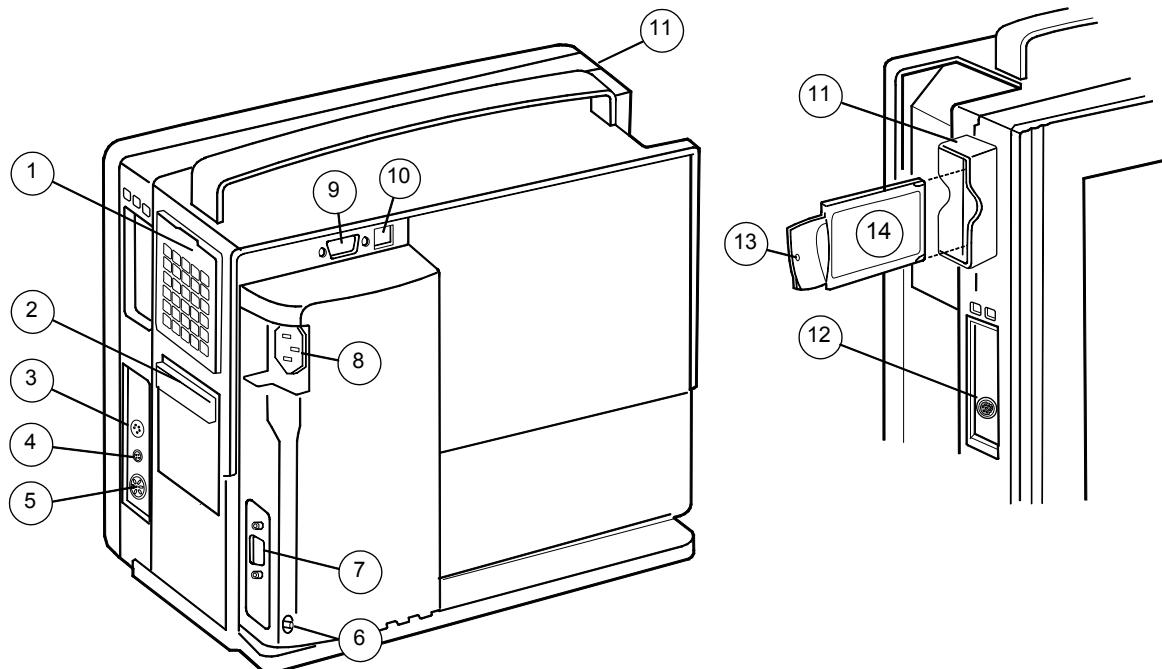
Figure 10   External connectors of Compact Monitor Frame rev.00...03

(1)   Dust filters

(2)   Recorder unit (optional)

(3)   Connector for factory use only

(4)   Synchronization connector

(5)   Connector for external keyboard (anesthesia record keeping solution keyboard), K-CREMCO or Barcode Reader

(6)   Potential equalization connector

(7)   Serial port connector

(8)   Receptacle for power cord

(9)   NET ID connector

(10) NET connector

(11)   WLAN antenna cover (optional)

(12) Connector for Device Interface Solution

(13) WLAN antenna card LED

(14) WLAN antenna card (optional)

DIS connector, X5 DIS interface

RS422 connector	Pin No.	Signal
	1	DIS_out +
	2	DIS_out -
	3	15V_DIS
	4	GND
	5	8V_DIS
	6	GND
	7	DIS_in +
	8	DIS_in -
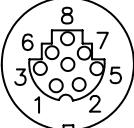
Network connector, X5

RJ45 connector	Pin No.	Signal
	1	Tx +
	2	Tx -
	3	Rx +
	4	N/C
	5	N/C
	6	Rx -
	7	N/C
	8	N/C

Coding element connector, X4

9 pin female D-connector	Pin No.	Signal
	1	IDCS1 (chip select)
	2	IDCL (clock)
	3	IDDI (data in)
	4	IDDO (data out)
	5	IDPE (protect enable)
	6	+5Vdc
	7	Direct ECG
	8	Nurse call
	9	GND

Direct ECG (pin 7)

Delay (max.): 15 ms

Gain ECG (in)/ECG (out): 1 mV/1V

NOTE: The direct ECG out signal is not available with modules M-ESTP rev. 01, M-EST rev. 00 and M-ETP rev. 00.

Nurse call (pin 8)

The nurse call signal is generated by the red and yellow alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high state range is from 2.8 to 5 V, while the low state range is from 0 to 0.8 V.

If the output signals are used simultaneously with the coding element, a B-UPINET Y-cable (order number 889308) should be used.

Keyboard connector, X9

5 pin connector	Pin	Signal
	1	KB_CLK
	2	KB_DATA
	3	not in use
	4	GND
	5	+4.75 - +5.25V
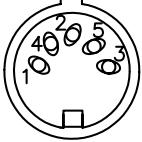
Synchronization connector, X8

4 pin female connector	Pin No.	Signal
	1	GND
	2	Def_Sync
	3	Direct ECG
	4	Pressure Out
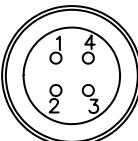
Direct ECG (PIN 3):

Delay (max.): 15 ms

Gain ECG (in)/ECG (out): 1 mV/1V

NOTE: The direct ECG out signal is not available with modules M-ESTP rev. 01, M-EST rev. 00 and M-ETP rev. 00.

Pressure out (PIN 4):

P1 from hemodynamic module

Gain Signal (out) / Pressure (in): 1V/100 mmHg

Pressure area 0...300 mmHg

RS232 Serial data connector X11

9 pin male D-connector	Pin No.	Signal
	1	GND
	2	RxD
	3	TxD
	4	NC
	5	GND
	6	N/C
	7	RTS
	8	CTS
	9	N/C

2.10.2 Serial data interface

The serial interface is an asynchronous RS-232 connection, which uses hardware flow control. The communication speed is 115.2 kbps. The communication uses the following parameters: Parity None, Data bits 8 and Stop bits 1.

2.10.3 Digital and analog outputs

Digital outputs

There are separate digital outputs. Both signals use TTL level. The outputs are: Defibrillation Sync. and Nurse Call.

The Defibrillation Synchronization Signal is obtained from Synchronization connector X8, pin 2.

The Nurse call is obtained from Coding element connector X4, pin 8.

Defibrillation Sync indication is generated by ECG. When active, the signal is in state 1. After 10 ms the signal is reset to state 0. New Defibrillation Sync is not generated before the indication is deactivated. The delay from the R wave peak to the start of the signal is maximally 35 ms.

Nurse Call indication is generated by red and yellow alarms. When activated, it is set to state 1 and remains at that state until the alarm situation is over or **SILENCE ALARM** key is pressed.

The range of state 0 is from 0 to 0.8 V, and the range of state 1 is 2.8 to 5 V.

Analog outputs

Compact Anesthesia/Critical Care Monitor produces two analog real-time signals. The Direct ECG signal is available in Coding element connector X4 pin 7 and Synchronization connector X8, pin 3. The other signal is Invasive pressure output. It is available in Synchronization connector X8 pin 4.

NOTE: When the source of the selected analog output becomes invalid (for example, transducer is disconnected), the last valid waveform information remains on the output and the numerical information is no longer valid.

Direct ECG
Delay (max.): 15 ms
Gain ECG (out)/ECG (in): 1 V/1 mV

NOTE: The direct ECG out signal is not available with modules M-ESTP rev. 01, M-EST rev. 00 and M-ETP rev. 00.

Invasive pressure signal: P1

Delay (max.): 25 ms

Gain Signal (out) / Pressure (in): 1V/100 mmHg

Pressure area 0...300 mmHg

The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 300 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k.

2.10.4 Printer connection

For connecting a printer to the monitor, the serial data interface is used. When parallel printing is desired, a serial to parallel converter (ref. 78030) is needed.

For further information see Part I, Interfacing.

3   Service procedures

3.1   General service information

The field service of the S/5 Compact Anesthesia Monitor and S/5 Compact Critical Care Monitor is limited to replacing faulty PC boards and mechanical parts. Return the faulty PC boards to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed fault description.

CAUTION   Only trained personnel with appropriate tools and equipment shall perform the tests and repairs outlined in this section. Unauthorized service may void the warranty of the unit.

3.2   Service check

S/5 Compact Anesthesia Monitor, F-CM(REC)1
S/5 Compact Critical Care Monitor, F-CMC(REC)1
Display Unit

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A"), which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check list should be signed after performing the procedure.

3.2.1   Recommended tools

Tool	Order No.	Notes
Power cord		
Screwdrivers		
MemCard - Menu		for MemCard Option
MemCard - Data		for MemCard Option
Anaesthesia Keyboard, K-ARKB		
K-ARK interface cable	881154	
Hemodynamic Module		

3.2.2 Recommended parts

Part	Order No.	Notes
Display Unit Fan filter	897010	
Recorder paper	74205	for recorder unit

3.2.3 Before beginning

- Make sure that the monitor is switched to standby.
- Disconnect the power cord and press the service reset switch until the LED next to it turns off.
- If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from the Frame Unit. Take out any memory cards, if installed.
- Detach the Display Unit from the Frame Unit.
- Open the Display Unit by detaching the Front Unit.

NOTE: Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.

3.2.4 Visual inspection

1. DC/DC power supply board

    Disconnect the DC/DC power supply board. Check the Display Unit – Frame Unit connector under the board:

    - screws are tightened properly
    - the connector is clean and intact

2. Central Processing Board

    Check the Central Processing Board in the Display Unit:

    - screws are tightened properly
    - cables are connected properly
    - all ICs that are on sockets are attached properly

3. DC/DC power board

    Reconnect and check the DC/DC Power Board:

    - screws are tightened properly
    - all connectors are clean and intact
    - the cables are attached properly

4. Net Unit and Synchronization Unit

    Check that:

- screws are tightened properly
- the connector pins are intact

5. Front Unit

    Check that:

    - the Connector Board screws are tightened properly and the cable connectors are clean and intact
    - the Inverter Board screws are tightened properly and the cable connectors are clean and intact
    - the Backlight cables are intact and attached properly
    - the keyboard foil cables are intact and attached properly to connectors on the Connector Board
    - the Connector Board foil cable is intact and attached properly to the connector on the Central Processing Board
    - the video signal foil cable is intact and attached properly to its connector on the Central Processing Board

    Reattach the Front Unit.

6. External parts

    Check external parts of the Display Unit:

    - all stickers are intact
    - the LCD display screen is intact
    - the ComWheel cover is intact and attached properly
    - all mechanical parts are functioning properly

    Connect the Display Unit to the Frame Unit.

7. Inserting module

    Check that the module used goes in smoothly and locks up properly in both module slots.

    Leave the module connected.

8. Fan filter

    Clean or replace the Display Unit fan filter.

3.2.5   Functional inspection

9.   Stand-by LED

Connect the power cord.

Check that the standby LED starts blinking or is on continuously, if the batteries do not need charging.

✍

10.   Start-up

Switch the monitor on.

Check that the monitor starts up properly, i.e. the alarm LEDs turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears.

No error messages should appear on the screen.

If the monitor contains the recorder unit, two lines of start-up information should be recorded.

✍

11.   Monitor screen configuration

Configure the monitor screen so that all the needed parameter information is shown:

Monitor Setup
>   *Screen 1 Setup*
>   *Waveform Fields*
>   *Digit Fields*

Check that the selected parameter information is shown on the screen.

NOTE: InvBP waveforms are not shown without a patient simulator. Do no connect the simulator to the monitor at this stage.

✍

12.   Mark Event or Take Snapshot

Push the menu keys *Help* and *Mark Event*, or *Take Snapshot.*

Check that the picture on the LCD display screen is straight, clear and stable.

✍

13.   Time and date

Check that the time and date are correct, adjust them if necessary.

Monitor Setup
>   *Set Time and Date*

NOTE: The selection SET TIME AND DATE cannot be accessed if a case is started, or a patient has been admitted.

NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/TIMEKEEPER battery needs to be replaced.

The FACTORY RESET should be performed after the battery replacement, see "Performing Factory Reset" .

✍

14. Loudspeaker

Check the loudspeaker by setting the alarm sound:

Alarms Setup
> *Alarm Volume*

Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

✍

15. Display brightness

Check the display brightness control:

Monitor Setup
> *Display Brightness*

Press the ComWheel and check that the display brightness follows the selected brightness.

✍

16. Monitor software

Enter the service menu:

Monitor Setup
> *Install Service* (Password 16-4-34)
>> *Service* (Password 26-23-8)

Take down the information regarding Monitor and Power Management Board software.

✍

17. Content of service log

Select *Service Log* from the menu.

Check the contents of the Service Log for possible problems. If the monitor contains the recorder unit, record the Service Log on the recorder by selecting *Record Log*.

✍

18. Power supply output voltages

Check the power supply unit output voltages through the service menu:

Monitor Setup
> *Install Service* (Password 16-4-34)
>> *Service* (Password 26-23-8)
>>> *Frame*
>>>> *Power Supply*

The Display Unit voltages should meet the following ranges:

+12V	11.50...12.50 V
+3.3 V	3.00...3.60 V
Vbus	10.00...17.00V
	Depends on the power source

✎

19. Watchdog circuitry

    Test the watchdog circuitry:

    Monitor Setup
    > ***Install Service*** (Password 16-4-34)
    >> ***Service*** (Password 26-23-8)
    >>> ***Set/Test***

    Perform the tests WATCHDOG and WD BY OVERLOAD. Check that the monitor restarts in each case.

    NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds.

✎

    Preset monitor settings:

    Record/Print
    > ***Record Waveforms***
    >> ***Waveform 1 --> ECG1***
    >> ***Waveform 2 --> P1***
    >> ***Waveform 3 --> P2***
    >> ***Delay --> Off***
    >> ***Paper Speed --> 6.25 mm/s***
    >> ***Length --> 30 s***

20. Alarm LEDs

    Enter the ***Keyboard*** service menu:

    Monitor Setup
    > ***Install Service*** (Password 16-4-34)
    >> ***Service*** (Password 26-23-8)
    >>> ***Keyboard***

    Select the text ***Upper Led.*** Check that the red alarm LED(s) is turning on and off when pressing the ComWheel. Check also the yellow alarm LED(s) by selecting ***Lower Led*** from the menu.

✎

21. Membrane keys check

    Press the keys on the monitor command board one by one. Check that each key generates a sound from the loudspeaker. Also, the corresponding text in the menu should change from yellow to red.

Check also the functioning of the side panel keys.

✍

22. ComWheel check

Turn the ComWheel clockwise and counter clockwise and check that each step generates a sound from the loudspeaker and the corresponding values at the bottom of the menu increase.

Select **Dummy Press.** Press the ComWheel and check that the press generates a sound and the corresponding value in the menu increases.

✍

23. K-ARK connector

Check that the command board section of the Anesthesia Keyboard functions normally through the K-ARK connector.

✍

24. Module communication

Connect a patient simulator to the module.

Enter the ESTP: ECG service menu:

Monitor Setup
> **Install Service** (Password 16-4-34)
>> **Service** (Password 26-23-8)
>>> **Parameters**
>>>> **ESTP: ECG**

Check that the Timeouts, Bad checksums and Bad c-s by mod values do not increase faster than by 5 per second.

Change the module into the other slot. When the module is recognized, check that the values do not still increase faster than by 5 per second.

✍

25. Battery

Enter the **Battery** service menu:

Monitor Setup
> **Install Service** (Password 16-4-34)
>> **Service** (Password 26-23-8)
>>> **Frame**
>>>> **Power Supply**
>>>> **Battery**

Check that the information on the page is correct.

✍

26. Battery voltage

    Check that the shown Battery Voltage value is within 10 – 17V.

    ✍

27. Monitor temperature

    Check that the shown Monitor Temperature value is within 20 - 40.

    ✍

28. Battery operation

    Disconnect the power cord (without switching the monitor to standby).

    Check that the monitoring continues normally. The battery indicator should appear in the upper right hand corner of the screen.

    ✍

29. Reconnecting the power cord

    Reconnect the power cord.

    Check that the monitoring continues without problems. The battery indicator should be replaced by the text CHARGE.

    ✍

Recorder Unit

30. Cover open recognition

    Open the recorder unit cover. Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.

    ✍

31. Recording

    Press the key **Record Wave** and check that the module starts recording the selected waveforms. Press the key **Stop** on the module to stop recording.

    NOTE: InvBP waveforms are not recorded without a patient simulator.

    NOTE: If no recording appears, check that the paper roll is installed in a correct way. Only one side of the paper is printable.

    ✍

32. Paper speed

    Press the key **Record Wave** again and this time wait until the recording stops. Check that the length of the recorded waveform scale is 18.7 cm ($\pm$ 1.5 cm).

    Change the paper speed setting to 1 mm/s:

Record/Print
Record Waveforms
Paper Speed --> 1 mm/s

Press the key **RECORD WAVE** and wait until the recording stops. Check that the length of the scale is now 3.0 cm ($\pm$ 0.5 cm).

33. Quality of recording

    Check that the quality of the recording is acceptable.

MemCard option

NOTE: The following steps are applicable only when the MemCard option is installed in the monitor.

34. Memory option recognition

    Enter the ***Memory Card*** service menu:

    Monitor Setup
    > ***Install Service*** (Password 16-4-34)
    >> ***Service*** (Password 26-23-8)
    >>> ***Frame***
    >>>> ***MemCards***

    Check that the memory option is recognized properly, i.e. Present and Active state YES.

35. Memories and PCMCIA controller test

    Check that the Memory board memories and the PCMCIA controller have passed their tests. The status for each should be OK.

36. Interface status

    Select ***Communication***. Check that Interface status states ACTIVE continuously and the error counter values at the bottom part of the menu are stable.

37. Menu Card recognition

    Select ***Module Status***. Insert a Memory card labelled Menu in the left hand side memory card slot. Check that the message 'Menu Card inserted' appears in the message field and the white menu card symbol in the upper right hand corner of the screen within 1 minute.

NOTE: The battery symbol overrides the memory card symbols.

38. Card type recognition

    Wait until the information regarding SLOT1 is fully updated in the service menu, then check that the Card type states MENU and the File system states ATA.

    Check that the rest of the information for SLOT1 is reliable and no errors have been detected.

    ✍

39. Data Card recognition

    Insert a Memory card labelled Data in the right hand side memory card slot. Check that the message 'Data Card inserted' appears in the message field and the green menu card symbol on the upper right hand corner of the screen within 1 minute.

    Wait until the information regarding SLOT2 is fully updated in the service menu, then check that the Card type states DATA and the File system states ATA.

    Check that the rest of the information for SLOT2 is reliable and no errors have been detected.

    ✍

40. Save and Load Modes

    Enter the **Save Modes** menu:

    Monitor Setup
    > *Install Service* (Password 16-4-34)
    > > *Save Modes* (Password 13-20-31)

    Save the current modes into the Menu card by selecting

    Load Modes
    > *To Memory Card --> Save.*

    Wait until the text 'Saved' appears, then return to the previous menu.

    Change the name for the mode number 1:

    Select the mode number 1, press the ComWheel and select -*Name.* Select suitable characters from the list by turning and pressing the ComWheel, then confirm the new name by selecting *End.*

    Load the original modes from the Menu card by selecting

    Load Modes
    > *From Memory Card --> Load*.

    Wait until the text 'Loading' changes to 'Loaded' (may take a couple of minutes), then return to the previous menu.

    Check that the mode number 1 has got back its original name.

    ✍

41. Data Card functions

    Press the membrane key **Display Trends** or **Pt.Data & Trends** --> *Trends*. Check that there is trend information available for the monitored parameters.

    Erase the trends:

>>> ***Reset Case***
>>>> ***Reset All --> Yes***
>> or
>> ***Admit/Discharge***
>>> ***Discharge --> Yes***

Check that the trends have been erased.

Reload the trends from the Data card by pressing the key **Patient Data** or **Admit/Discharge**, selecting ***Patient from Card***, pressing the ComWheel on the last saved file (the file information is shown at the bottom of the menu) and selecting ***Load***.

Wait until the message 'Loading from Mem. Module' disappears, then check that the original trends are available again.

✍

Network option

NOTE: The following steps are applicable only when the Network option is installed in the monitor.

42. Connection to Network

   Check that the Mon-Net cable connector is clean and intact, then connect it to the network connectors on the Frame Unit.

   Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears under the clock in the upper right hand corner of the screen. Also a message regarding the connected Central should appear in the message field of the screen.

   NOTE: The battery symbol overrides the network symbol in Compact Monitor.

   If the message regarding the Central does not appear, check the status of the network.

   ✍

43. Ethernet address

   Enter the network board service menu:

   Monitor Setup
   >> ***Install Service*** (Password 16-4-34)
   >>> ***Service - Frame*** (Password 26-23-8)
   >>>> ***Network***

   Take down the monitor's Ethernet address, which is shown beside the text Address.

44. Data counters

   Check that the service menu counters for the received ('In') and transmitted ('Out') data are updated frequently.

   ✍

45. Data error counters

   Check that the counters for data errors (CRC, Frame, Transm.) are stable.

NOTE: The counters may show values higher than 0. However, if any of the values is increasing continuously, it indicates a problem.

✍

46. Hardware error counters

Check that the counters for hardware errors (Intern., Missed, FIFO, Overrun) show all 0. If any of the counters show a value higher than 0, replace the network board.

✍

47. Disconnection recognition

Disconnect the Mon-Net cable from the Frame Unit. Check that the message 'Network down:' appears in the message field within 30 seconds. When the message appears, the service menu values are no longer updated.

Reconnect the Mon-Net cable and check that the monitor connects to the Datex-Ohmeda Network again.

✍

48. ID-plug recognition

Switch the monitor to standby. Disconnect the Identification plug from the Frame Unit. Switch the monitor back on and check that the message 'Check network connectors' appears in the message field.

Reconnect the Identification plug and check that the monitor connects to the Anaesthesia Network.

✍

Wireless LAN option

49. Signal strength

Check that the green LED on the wireless antenna card blinks and the WLAN signal strength symbol roams or stays fixed on the monitor screen.

✍

50. Configure access point

Configure one access point appropriately. Bring the Compact Monitor to good WLAN coverage area. Check that the field level indicator stops scrolling.

Go to the ***WLAN Status page (... Service -> Frame -> Network -> WLAN - WLAN Status).***

Check that the Connection is active, AP MAC address is recognized and the connection speed is at least 2 Mbits/s.

✍

51. Connection to the Network

    Make sure that the monitor's wireless LAN antenna card is in line of sight with a wireless LAN access point antenna. Check that the monitor connects to the Datex-Ohmeda Network, i.e. the wireless LAN network symbol appears in the upper right-hand corner of the screen.

    ✍

General

52. Trend retaining

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

    Press the membrane key **Display Trends** or **Pt.Data & Trends --> *Trends*.** Check that there is trend information available for the monitored parameters.

    Switch the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and switch the monitor back on.

    Check that the trend information is still available.

    ✍

53. Service reset switch check

    Switch the monitor to standby and disconnect the power cord. Press the service reset switch for at least five seconds. Check that the LED next to the switch turns off, and also the fan turns off.

    Reconnect the power cord and turn the monitor back on. Check that all trends have now been erased.

    ✍

54. Battery capacity

    Test the batteries by performing the following:

    - detach all modules
    - keep the monitor connected to the mains power until the batteries are fully charged
    - install a Hemodynamic Module and disconnect the power cord
    - notice the time the monitor stays on with batteries

    Replace the batteries, if the time was less than 45 minutes.

    ✍

55. Service Log reset

    Enter the **Service Log** in the service menu:

    Monitor Setup
    > ***Install Service*** (Password 16-4-34)
    >> ***Service*** (Password 26-23-8)
    >>> ***Service Log***

    Clear the content of the Service Log by selecting RESET LOG from the menu.

    ✍

56. Electrical safety check

   Perform an electrical safety check and a leakage current test.

   Check that the monitor functions normally after the performed electrical safety check.

   ✎

57. Final cleaning

   Switch the monitor to standby, disconnect the power cord and perform final cleaning.

   ✎

   Fill in all necessary documents.

3.3 Disassembly and reassembly

WARNING   **The S/5 Compact Anesthesia/ Critical Care Monitor is always energized by the internal battery. A short circuit may cause internal damage. Do not touch any exposed wiring or conductive surface inside, this may cause an electric shock.**

CAUTION   Perform leakage current measurement whenever service or repair has been done in the monitor.

⚡   NOTE: The backlight circuit runs on a high voltage. Do not touch the inverter board or the backlight tube leads when powered.

3.3.1   To disassemble the Display Unit F-CM(C)1 rev.04

1.   Set the Compact Monitor lying on its rear side.
2.   Turn the quick lock screw at the bottom of the Display Unit counter clockwise to release it.
3.   Pull the Display Unit carefully upwards.
4.   Set the Display Unit lying on its front side; be careful not to damage the ComWheel or the LCD screen.
5.   Open and detach the four screws with the washers at the corners of the Display Unit.
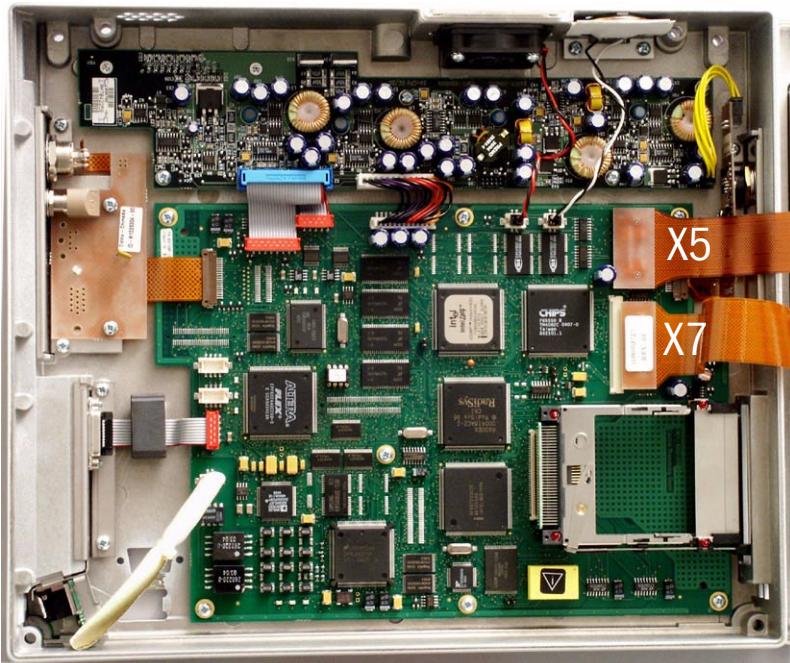
6.   Lift the Display Unit carefully from the side of the unit (Note that the Front Unit is connected with flat cables to the Central Processing Board). Detach the two flat cables from the CPB X7 and X5 connectors. Please note that the connectors are fragile; do not bend them while disconnecting the cables.
7.   Lay the Display Unit carefully on the table.

3.3.2 To disassemble the Display Unit of F-CM(C)(REC)1 rev.00...03

1. Set the Compact Monitor lying on its rear side.

2. Turn the quick lock screw at the bottom of the Display Unit counter clockwise to release it.

3. Pull the Display Unit carefully upwards and detach the Network and NetID cables.

4. Set the Display Unit lying on its front side; be careful not to damage the ComWheel or the LCD screen.

5. Open and detach the four screws with the washers at the corners of the Display Unit.
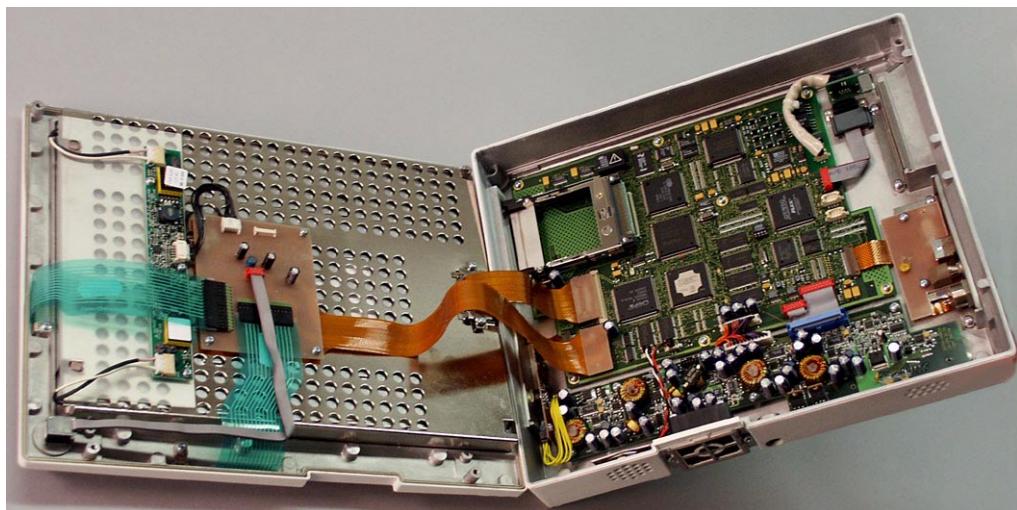
6. Lift the Display Unit carefully from the side of the unit (Note that the Front Unit is connected with short flat cables to the Central Processing Board). Detach the two flat cables from the CPB X7 and X5 connectors. Please note that the connectors are fragile; do not bend them while disconnecting the cables.

7. Lay the Display Unit carefully on the table.

3.3.3   To remove the Central Processing Board (CPB) from the Display Unit Back Unit

1. Disassemble Display Unit.
2. Detach the fan and loudspeaker cables from the CPB, connectors X17 (loudspeaker) and X16 (fan).
3. Detach the power cables coming from the DC/DC board, connector X10.
4. Detach the Signal cables (two) coming from the DC/DC board, connectors X23 and X19.
5. Detach carefully the Synchronization board foil cable by opening the lock at the connector X9 and pulling the foil out.
6. Detach the NetID cable from the CPB, connector X8.
7. Detach the Network cable from the CPB, connector X20.
8. Open the seven screws holding the CPB.
9. Lift the CPB carefully from the Display Unit.

3.3.4   To remove the Display Unit DC/DC power board

1. Disassemble the Display Unit.
2. Detach the fan and loudspeaker cables from the CPB, connectors X17 and X16.
3. Detach the power cables leading to the CPB.
4. Detach the signal cables leading to the CPB.
5. Open the four screws holding the DC/DC power board.
6. Lift the DC/DC power board carefully from the Display Unit.

3.3.5   To remove the Synchronization Unit

1.   Disassemble the Display Unit.
2.   Detach carefully the Synchronization board foil cable by opening the lock at the connector X9 and pulling the foil out.
3.   Open the two screws holding the whole unit in the Display Unit back cover.

NOTE: Do not open the screws holding the Synchronization board in the Synchronization Unit.

3.3.6   To remove the Net Unit

1.   Disassemble the Display Unit.
2.   Detach the NetID and Network cables from the CPB, connectors X8 and X20 respectively.
3.   Open the two screws holding the Net Unit in the Display Unit cover.
4.   Open the two screws holding the ID connector in the Display Unit back cover (from the outer side of the cover).

3.3.7   To remove the loudspeaker and fan

1.   Disassemble the Display Unit.
2.   Detach the loudspeaker and fan cables from the CPB, connectors X17 and X16 respectively.
3.   Open the screws holding the loudspeaker and fan.

NOTE: When reassembling, be sure to connect the cables to correct connectors on the PCB.

3.3.8   Disassembling the Connector Board and Inverter Board

1.   Disassemble the Display Unit.
2.   Set the Front Unit carefully lying with the LCD screen downwards. Note! Be careful not to damage the LCD screen or the ComWheel.
3.   Detach carefully the lower keyboard flat cable from the Connector Board.
4.   Detach carefully the side panel keyboard flat cable from the Connector Board.
5.   Detach the Connector Board – Inverter Board cable.
6.   Detach the ComWheel cable.
7.   Open the four screws holding the Connector board and remove it.
8.   Detach the backlight cables from the Inverter Board.
9.   Open the three screws holding the Inverter Board.

NOTE: The Inverter Board is sensitive to bending.

NOTE: When replacing the Inverter Board, fasten the inverter screws gently, using only as much force as necessary to fasten the board firmly enough in place. The screws must not be fastened so tightly that the board will be bent from around the screws. Also, do not bend or twist the Inverter Board during the assembly.

3.3.9   To Disassemble the LCD Display Element, F-CM(C)(REC)1 rev. 00

NOTE: Wear a static control wrist strap and soft cotton gloves (dust free) when handling the LCD display parts. Hold them by their corners or edges. Do not touch the connector pins.

In normal circumstances it is very difficult to keep the LCD Display component and the display shield surfaces free of dust when the LCD Display unit package is opened and they are exposed to room air. If dust particles remain on the LCD Display component and the display shield surfaces, they may impair the picture quality on the screen.

In case you need to detach the LCD Display component for repair, you may return it to be repaired at GE Healthcare. If you can provide a dustfree environment, follow the instructions below. See also Exploded view of the Display Unit, Front Unit, F-CM(C)(REC)1 Rev. 00.

1. Disassemble the Display Unit.
2. Detach carefully the lower keyboard flat cable from the Connector Board.
3. Detach carefully the side panel keyboard flat cable from the Connector Board.
4. Detach the ComWheel cable.
5. Detach the backlight cables from the Inverter Board.
6. Open the four screws holding the LCD Display Unit and the metal EMC cover in the Display Unit front cover.
7. Open the two screws covering the video flat cable connector in the LCD Display element.
8. Lift the EMC cover carefully up.
9. Lift the LCD Display element carefully up.

NOTE: Do not use excessive force when fastening the display component to the metal frame. Fastening the screws too tightly might bend the display module too much and break it. The screws must also be fastened gradually: first fasten all screws slightly, then more tightly.

NOTE: When reassembling the LCD Display component, be careful that no dirt or finger prints are left between the LCD element and the protection glass window.

NOTE: If the LCD Display unit is broken, handle it carefully to avoid injury (the LCD Display component and the backlight lamp(s) are made of glass). Wash your hands if you touched liquid crystal, which may flow out from a broken LCD Display component.

NOTE: Do not touch, push or rub the exposed display module surface. Keep the surface clean. In case of accidental mishandling, see the instructions following this chapter.

3.3.10 To Disassemble the LCD Display Element, F-CM(C)(REC)1 rev.01, F-CM(C)1 rev.02...04

NOTE: Wear a static control wrist strap and soft cotton gloves (dust free) when handling the LCD display parts. Hold them by their corners or edges. Do not touch the connector pins.

In normal circumstances it is very difficult to keep the LCD Display component and the display shield surfaces free of dust when the LCD Display unit package is opened and they are exposed to room air. If dust particles remain on the LCD Display component and the display shield surfaces, they may impair the picture quality on the screen.

In case you need to detach the LCD Display component for repair, you may return it to be repaired at GE Healthcare. If you can provide a dustfree environment, follow the instructions below. See also Exploded view of the Display Front Unit, F-CM(C)(REC)1 rev. 01, F-CM(C) rev 02.

1. Disassemble the Display Unit.
2. Detach carefully the lower keyboard flat cable from the Connector Board.
3. Detach carefully the side panel keyboard flat cable from the Connector Board.
4. Detach the ComWheel cable.
5. Detach the backlight cables from the Inverter Board.

6. Open the four screws holding the metal EMC cover in the Display Unit front cover.

7. Open the two screws covering the video flat cable and ferrite in the LCD Display element.

8. Lift the EMC cover carefully up.

9. Open the four screws holding the LCD element in the Display Unit front cover.

10. Lift the LCD Display element carefully up.

NOTE: Do not use excessive force when fastening the display component to the metal frame. Fastening the screws too tightly might bend the display module too much and break it. The screws must also be fastened gradually: first fasten all screws slightly, then more tightly.

NOTE: When reassembling the LCD Display component, be careful that no dirt or finger prints are left between the LCD element and the protection glass window.

NOTE: If the LCD Display unit is broken, handle it carefully to avoid injury (the LCD Display component and the backlight lamp(s) are made of glass). Wash your hands if you touched liquid crystal, which may flow out from a broken LCD Display component.

NOTE: Do not touch, push or rub the exposed display module surface. Keep the surface clean. In case of accidental mishandling, see the instructions following this chapter.

3.3.11 Changing the LCD backlights, F-CM(C)(REC)1 rev.00

1. Disassemble the Display Unit.

2. Detach the backlight cables from the Inverter Board.

3. Push the lid beside the backlight to release the backlight tube. Pull the backlight out.

NOTE: Do not bend the backlight tube.

NOTE: Do not touch the backlight tube with your hands.

3.3.12 Changing the LCD backlights, F-CM(C)(REC)1 rev.01, rev.02

1. Disassemble the Display Unit.

2. Detach carefully the lower keyboard flat cable from the Connector Board.

3. Detach carefully the side panel keyboard flat cable from the Connector Board.

4. Detach the ComWheel cable.

5. Detach the backlight cables from the Inverter Board.

6. Open the four screws holding the metal EMC cover in the Display Unit front cover.

7. Open the two screws covering the video flat cable and ferrite in the LCD Display element.

8. Lift the EMC cover carefully up.

9. Release the screw holding the backlight tubes in their place.

NOTE: The screw cannot be removed totally, only released.

10. Detach the backlight tube by sliding it to the left and then lift it up.

NOTE: Do not bend the backlight tube.

NOTE: Do not touch the backlight tube with your hands.

3.3.13 Changing the LCD backlight, F-CM(C)1 rev.03 and rev.04

Perform the steps 1-8 as in section

1. Detach the screw holding the backlight tube set in place.

2. Detach the backlight tube set by pulling it to the left.

NOTE: Do not bend the backlight tube.

NOTE: Do not touch the backlight tube with your hands.

3.3.14 Handling and storage of LCD Display component

Handling of LCD Display component and protective window

If the LCD Display component surface becomes dusty, wipe it gently with absorbent cotton, chamois or other soft material. If necessary, breathe onto the display surface and wipe immediately. The display surface may also be cleaned using a small amount of normal hexane. Do not use acetone, toluene or alcohol because they cause chemical damage to the polarizer.

1. Wipe off saliva and water drops as soon as possible. Their prolonged contact with the polarizer cause deformations and color fading.

2. Do not open the component case because internal circuits are sensitive to electrostatic discharges.

Taking a spare part LCD Display component or a display shield into use:

Peel off the protective film slowly (in more than 10 seconds) from the display or protective window surface. Fast peeling may generate enough static electricity to destroy the LCD Display component.

Storaging an LCD Display component as a spare part for a long period

1. Store the display in a dark place. Do not expose it to sunlight or fluorescent light. Keep the temperature between 5 °C and 35 °C at normal humidity.

2. The polarizer surface should not come into contact with any other object. It is recommended that the display unit is stored in the container in which it was originally shipped.

3.3.15 Downloading the software on empty Central Processing Board

In case of a faulty Central Processing Board refer first to chapter "To remove the Central Processing Board (CPB) from the Display Unit Back Unit" and then follow the instructions for downloading service software below.

NOTE: All user settings will be lost after downloading of a new monitor software.

NOTE: During the downloading of the software, the serial number of the monitor is written on the software card. The software can then be downloaded again to the same monitor, but not to any other monitor.

1. Make sure that the monitor is switched to standby. Press and hold the service reset button on the rear panel for at least five seconds or until the service reset indicator LED turns off.

2. Open the cover for card drive slots, if installed. Insert the software card into one of the card drive slots and press the software card firmly in position.

3. Make sure that at least 30 seconds have passed since the service reset, then switch the monitor on.

4. Wait for approximately 80 seconds. After the start-up screen appears, enter the Service View and make sure that the information regarding the monitor software has been updated. Memorize the serial number of the new software.

5. Remove the software card.

6. Replace the original device plate for monitor software by the new one supplied with the software card.

7. Perform Factory Reset. Make sure that the monitor functions normally after the restart.

8. Set the time and date.

9. Set the monitor's network communication according to the used network software, if necessary.

The communication is set in the monitor's **Network** service menu.

Network software S-CNET99 -> DRI Level = 1999

Network software S-CNET01 -> DRI Level = 2001

Network software S-CNET02 -> DRI Level = 2001 or 2002 (WLAN)

Network software L-NET03 -> DRI Level = 2003

Network software L-NET05 -> DRI Level = 2005

NOTE: The DRI Level 1999 is not selectable in all monitor software versions.

NOTE: If the DRI level is changed, the monitor will restart automatically.

Fill out all necessary documentation regarding the new monitor software.

NOTE: The license agreement of monitor software needs to be in accordance with the monitor software serial number. Make sure you archive the license agreement in a secure location.

NOTE: The first start-up after software loading takes considerably longer.

See also the troubleshooting chart for the software card, if necessary.

3.3.16 Performing Factory Reset

NOTE: The factory reset is necessary after replacing monitor software.

NOTE: The factory reset will restore all customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.

2. Select **Install/Service** and password (16-4-34).

3. Select **Service** and password (26-23-8).

4. Select **Set/ Test** and **Factory Reset**.

5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually.

3.4 Adjustments and calibrations

It is not necessary to perform calibrations or adjustments on S/5 Compact Monitors.

4   Troubleshooting

4.1   General (Display Unit)

Trouble	Cause	Treatment
Monitor is not starting	1. On/Stby key pressed too long. 2. The batteries are empty. 3. If power cord connected, AC/DC power unit may be faulty. 4. If AC/DC power unit is working, the PMB board in the Frame Unit may be faulty. 5. On/Stby key may be faulty.	1. On/Stby key may be pressed less than 10 s. 2. Connect the power cord. 3. Exchange the AC/DC power unit. 4. Exchange the PMB board. 5. Exchange the DU side panel keyboard foil.
Monitor is not starting, the Frame Unit back panel led is lit.	1. The connection between Frame Unit and Display Unit may be faulty. 2. Display Unit voltages are not OK. 3. Faulty Central Processing Board.	1. Check the connector and the cables between Display Unit and Frame Unit. 2. Replace the Display Unit DC/DC power board. 3. Replace the Central Processing Board.
The monitor starts (Frame Unit back panel led is lit and a beep is heard), but the display remains black.	1. The LCD display cables are loose. 2. The backlights are not lit.	1. Check the LCD cables and connectors on the Central Processing Board and in the Front Unit. 2. Connector Board cable may be loose. Check the cable. Backlights may be faulty. Exchange them. Backlight Inverter may be faulty. Exchange the Inverter.
Module data disappears from the screen.	Parameter module current (in PMB) too high.	Detach and change the parameter module. PMB module power section may be faulty. Exchange the PMB.
'Battery failure' message on the display.	1. Problem in communication between Display Unit and Frame Unit (in Service View PMB serial number and other data faulty) 2. PMB in Frame Unit may be faulty	1. Check the connectors and cables between Display Unit and Frame Unit. 2. Exchange the PMB.
Recorder is not working properly.	1. Recorder communication problem. 2. Problem in voltages in Frame Unit.	1. Check the connectors and cables between Display Unit and Frame Unit. 2. Check the Frame Unit voltages from the service menu. If not OK, replace the PMB board.
Keyboard not working, but module communication is OK.	Keyboard cables and connectors, or Connector Board cable and connector) may be faulty.	Check the Connector Board cable and connector. Check the keyboard cable connection to the connector board.
Keyboard not working, and module communication not working.	UPI section of the Central Processing Unit not functioning normally.	Restart the monitor. Replace the Central Processing Board.
Keyboard partly not working.	1. Keyboard faulty. 2. Connector Board faulty	1. Replace the keyboard foil. 2. Replace the Connector Board.
'Display temperature high' and 'Check dust filter' messages.	The temperature inside the display unit has been more than 55 °C for two minutes at the minimum.	Check and change the dust filter if necessary.

Trouble	Cause	Treatment
'Battery temperature high' and 'Check dust filter' messages.	The temperature of the batteries is more than 53 °C.	Check and change the dust filter if necessary.
Display Unit is too warm.	Display Unit Fan is not working.	Check the Fan cable is connected to the correct connector.
After shut off, the trend and patient data does not remain 15 min in the memory.	The On/Stby switch has been pressed for over 10 s. (= service reset)	When switching off, the On/Stby switch has to be pressed for less than 10 s.

4.2   Software License (service software)

Trouble	Cause	Treatment
New software is not downloaded or Start-up display does not appear in 80 seconds.	1. The software card is not properly inserted. 2. The software card does not contain proper software.	1. Check the software card's connection in drive. 2. Check that correct software card is inserted in drive.
The software serial number in the Service view is not correct after downloading.	The software has not been downloaded correctly.	Check the software card's connection in drive. Try downloading once again. Try with an other software card. Please read the note below*

NOTE: You can download the software only onto one monitor. During the downloading of software the serial number of the monitor is written on the software card, and if the loading for some reason would fail, the software can be downloaded again onto the same monitor, but not onto any other monitor.

4.3   Error messages

Message	Explanation
SRAM Error	The SRAM memory is located on the CPU board. The SRAM Error is due to memory malfunction. Restart the monitor. If the problem persists, replace the SRAM/Timekeeper battery. Remember to perform factory reset after the replacement.
EPROM Error	The EPROM Error message is displayed due to problems in the communication between the CPU board and the software flash memory. Replace the CPU board. Remember to perform factory reset after the replacement.
EEPROM Error	The EEPROM memory is located on the CPU board. The EEPROM Error message is displayed due to memory malfunction. Perform factory reset. If the problem persists, replace the CPU board. Remember to perform factory reset after the replacement.
RAM Error	The RAM memory is located on the CPU board. The RAM Error message is displayed due to memory malfunction. Replace the CPU board. Remember to perform factory reset after the replacement.

4.4   Memory Option

Trouble	Cause	Treatment
'Two Data Cards in mem. module' message	Two Data cards detected.	Remove MemCard from the left hand side slot of the module.
'Two Menu Cards in mem. module' message	Two Menu cards detected.	Remove MemCard from the right hand side slot of the module.
'No menus in Menu Card' message	There are no menus in the Menu card.	Insert a Menu card with valid menu configuration files in the module.
'Faulty Data Card - change card' message	An error has occurred during Data card read/write operation	Change Data card.
'Faulty Menu Card - change card' message	An error has occurred during Menu card read/write operation	Change Menu card.

4.5   Troubleshooting for the NET section

Trouble	Cause	Treatment
Monitor does not connect to the network. Monitor connects to the network, but disconnects unexpectedly ('Network connection down' message on the monitor screen).	Patch panel	Patch cable not connected to HUB or to panel.
	Patch cable	Patch cable or connector defective.
		HUB not connected to the power supply.
		HUB port closed due to physical layer problems.
		HUB port temporarily closed and reopened due to physical layer problems.
		Hubs not properly connected to each other.
	Monitor-Network cable	Cable not properly connected to the wallplate or to the monitor.
	Monitor-Network cable	Cable or connector defective.
	Net section of the CPB	The NET section is defective. Replace the CPB.
	NET section memory on the CPB	The SRAM of the NET section is defective or uninitialized. The NET cannot be used. See network service page for details.
	Identification plug	There is no identification plug attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used.
Monitor does not connect to the Network	No Network Option in the monitor	Download the Network option from the appropriate software card.
'Check network connectors' message shows on the monitor screen	Monitor-Network cable	Cable not properly connected to the wallplate or to the monitor.
		Cable or connector defective.
	Identification plug	There is no identification plug properly attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used. See network service page for details.

'Network board error' message shows on the monitor screen	NET section on the CPB	The NET section is defective. The board cannot be used. See network service page for details.
	NET section memory on the CPB	The SRAM memory of the NET section is defective or uninitialized. The board cannot be used. See network service page for details.
Other Site View shows no waveforms	No waveforms are set up for Monitor-to-Monitor communication	Run Datex-Ohmeda Network Setup to verify current Monitor-to-Monitor communication setup.
Network printing fails	Print server is busy	Network manager's print server is busy at the moment and cannot take more print jobs. Try again after 15 seconds.
	Print queue is full	There are too many unprinted documents waiting in the print queue. Check the printer, as it is not operating properly.
	Printer is off-line	Printer cable is loose, printer is out of paper, there is a paper jam or the printer is simply switched to off-line state.
Record keeper menus are blank	There are no menus for the record keeper	Run Datex-Ohmeda Network Setup to verify the current set up.

5   Earlier revisions

This manual fully supports the earlier revisions of the S/5 Compact Anesthesia and Compact Critical Care Monitors.

APPENDIX A   Service check form, S/5 Compact Anesthesia Monitor, S/5 Compact Critical Care Monitor

Customer		
Service	Module type	S/N
Service engineer		Date

Monitor Installation			
F-	E-	E-	
S-	E-	M-	
L-	M-	N-	

OK = Test OK   **N.A. = Test not applicable**   **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. DC/DC power supply board	☐	☐	☐	2. Central Processing Board	☐	☐	☐
3. DC/DC power board	☐	☐	☐	4. Net Unit and Synchronization Unit	☐	☐	☐
5. Front Unit	☐	☐	☐	6. External parts	☐	☐	☐
7. Inserting module	☐	☐	☐	8. Fan filter	☐	☐	☐
9. Stand-by LED	☐	☐	☐	10. Start-up	☐	☐	☐
11. Monitor screen configuration	☐	☐	☐	12. Mark Event or Take Snapshot	☐	☐	☐
13. Time and date	☐	☐	☐	14. Loudspeaker	☐	☐	☐
15. Display brightness	☐	☐	☐		☐	☐	☐
16. Monitor software	L			Power Management board software			
17. Content of service log	☐	☐	☐				

18. Power supply output voltages				
+12 V			11.50...12.50 V	
+3.3 V			3.00....3.60 V	
Vbus			10.00...17.00	

	OK	N.A.	Fail		OK	N.A.	Fail
19. Watchdog circuitry	☐	☐	☐	20. Alarm LEDs	☐	☐	☐
21. Membrane keys check	☐	☐	☐	22. ComWheel check	☐	☐	☐
23. K-ARK connector	☐	☐	☐	24. Module communication	☐	☐	☐
25. Battery	☐	☐	☐				

26. Battery voltage			10...17 V	
27. Monitor temperature			20...40 C	

28. Battery operation	☐	☐	☐	29. Reconnecting the power cord	☐	☐	☐

Notes

Recorder unit							
	OK	N.A.	Fail		OK	N.A.	Fail
30. Cover open recognition	☐	☐	☐	31. Recording	☐	☐	☐
32. Paper speed	☐	☐	☐	33. Quality of recording	☐	☐	☐

Notes

MemCard Option					**S/N**		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
34. Memory option recognition	☐	☐	☐	35. Memories and PCMCIA controller test	☐	☐	☐
36. Interface status	☐	☐	☐	37. Menu Card recognition	☐	☐	☐
38. Card type recognition	☐	☐	☐	39. Data Card recognition	☐	☐	☐
40. Save and Load Modes	☐	☐	☐	41. Data Card functions	☐	☐	☐
Notes							

Network Option					**S/N**		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
42. Connection to Network	☐	☐	☐	43. Ethernet address	_____		
44. Data counters	☐	☐	☐	45. Data error counters	☐	☐	☐
46. Hardware error counters	☐	☐	☐	47. Disconnection recognition	☐	☐	☐
48. ID-plug recognition	☐	☐	☐				
Notes							

Wireless LAN option					**S/N**		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
49. Signal strength	☐	☐	☐	50. Configure access point	_____		
51. Connection to the Network	☐	☐	☐				
Notes							

General

	OK	N.A.	Fail		OK	N.A.	Fail
52. Trend retaining	☐	☐	☐	53. Service reset switch check	☐	☐	☐
54. Battery capacity	☐	☐	☐	55. Service Log reset	☐	☐	☐
56. Electrical safety check	☐	☐	☐	57. Final cleaning	☐	☐	☐

Notes

Used spare parts			

Signature

Datex-Ohmeda

S/5^{TM} Compact Anesthesia Monitor, F-CM1 (Rev. 04), F-CMREC1 (Rev. 01); Frame Unit AC/DC Power Supply Unit

S/5^{TM} Compact Critical Care Monitor, F-CMC1 (Rev. 04), F-CMCREC1 (Rev.01); Frame Unit AC/DC Power Supply Unit

Technical Reference Manual

All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.

Outside the USA, check local laws for any restriction that may apply.

Document no. M1044470-01
March, 2006

Table of contents

Introduction

This section provides information about the maintenance and service of the following products:

- S/5 Compact Anesthesia Monitor frame F-CM1 and S/5 Compact Critical Care Monitor frame F-CMC1 (including the AC/DC power unit, battery and Power Management Board).

- S/5 Compact Anesthesia Monitor frame F-CMREC1 and S/5 Compact Critical Care Monitor frame F-CMCREC1 (in addition to the above mentioned parts also a built-in recorder).

All the service menus related to the monitor are described in a separate "Service Menu" slot and the spare part lists in the "Compact Monitors Spare Parts" slot.

NOTE: Printings on thermal paper may be destroyed when exposed to light, heat, alcohol, etc. Take a photocopy for archive.

1 Specifications

Dimensions	335 x 205 x 340 mm / 13.2 x 8.1 x 13.4in
	(W x D x H)
Weight	8.5 kg (19.4 lbs) (w/o modules)

Electrical Requirements

Power supply	
Rated voltage range and frequencies	100 to 240 VAC 50/60 Hz
	(limits 90-264 VAC)
Stability	±10 % of nominal voltage
Power consumption	140 VA (max)
Fuses	2x2A, T/SLOW, 250 V
Grounding	Hospital grade
Interruptability	Data memory and alarm settings are saved up to 15 minutes after monitor standby

Battery

Battery type	NiMH, 3.5Ah
Battery charging time	10 hours to full capacity
Battery operation	up to 1.5 hours typical on full charge at 23 °C / 73 °F
Recharging	when connected to mains power
Battery operaton alarm	
early warning	'Battery low' note
final warning	'Battery low' alarm
Battery state indicator	Capacity bar displayed on the screen

Environmental Requirements

Operating temperature	10 - 35 °C / 50 - 95 °F
Storage temperature	-10 - 50 °C / 14 - 122 °F
Atmospheric pressure	500 - 800 mmHg (660 - 1060 mbar, 66 - 106kPa)
Humidity	10 - 90 % non-condensing

In-built recorder

Power consumption	3 W
Principle	Thermal array
Print resolution	
Vertical	8 dots/mm (200 dots/inch)
Horizontal	32 dots/mm (800 dots/inch) at a speed of 25 mm/s and slower
Paper width	50 mm, printing width 48 mm
Traces	Selectable 1, 2, or 3 traces
Print speed	1, 6.25, 12.5, 25 mm/s

2   Functional description

The Frame Unit consists of the following parts:

- PMB (Power Management Board)
- PMB connector board(s)
- connector board PMB-REC (in the side frame unit)
- two batteries
- AC/DC power unit
- optionally in-built recorder

The left side of the Frame Unit has places for two double-width modules or four single-width modules.

The network signals are led through their own cables to the Frame Unit. The connectors are placed on the left side of the Frame Unit in frame version F-CM(C)1 (rev.04). In frame versions F-CM(C)(REC) (rev.00...03) the connectors are placed on the back plate of the Frame Unit.

The serial data interface is led through the Frame Unit to the AC/DC power unit. The serial connector is located at the side of the AC/DC power unit.
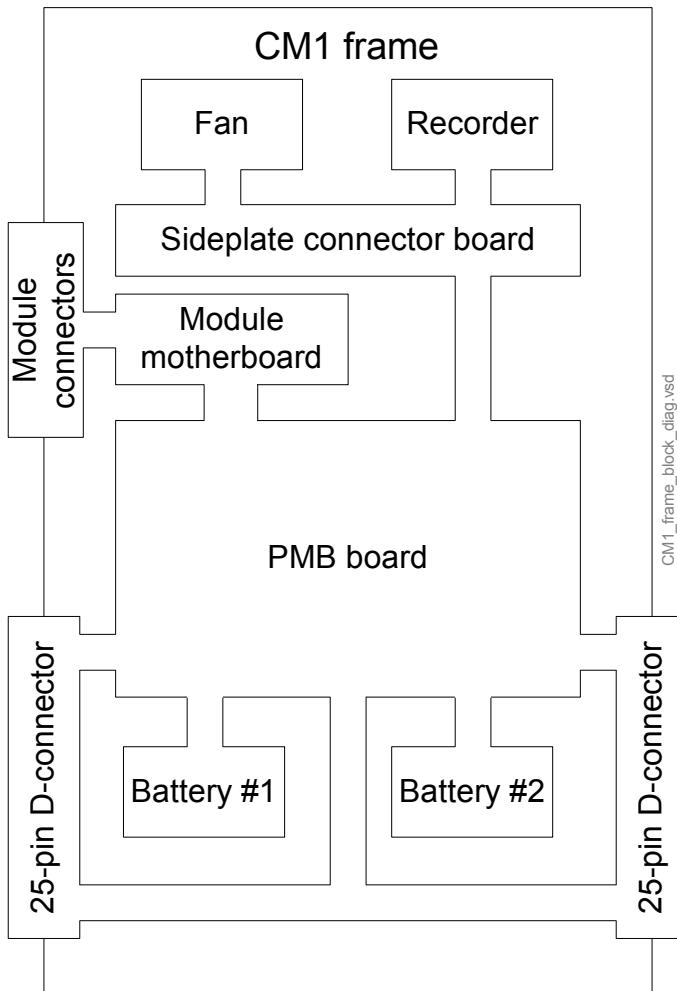
Figure 1   **Frame block diagram**

2.1   PMB connector board

The PMB connector boards are small boards connected together by a ribbon cable and are both equipped with the D-25 connectors, one for AC/DC unit and the other for the Display Unit. The board with the Display Unit connector has also a 16-pin connector for the PMB board.

The PMB connector boards route signals between the AC/DC unit, PMB board and Display Unit. Signals are transferred via a ribbon cable between the D-connector boards (connected to the AC/DC and DU). Power lines are transferred separately through the PMB.

2.2   Connector board PMB-REC

The connector board PMB-REC is the one mounted in the Side Frame unit, and connected to the PMB board via a 15-pin D-connector when inserted into the frame. The connector board PMB-REC routes operating voltage and signals for the frame cooling fan and for the recorder unit (optional).

2.3   PMB (Power Management Board)
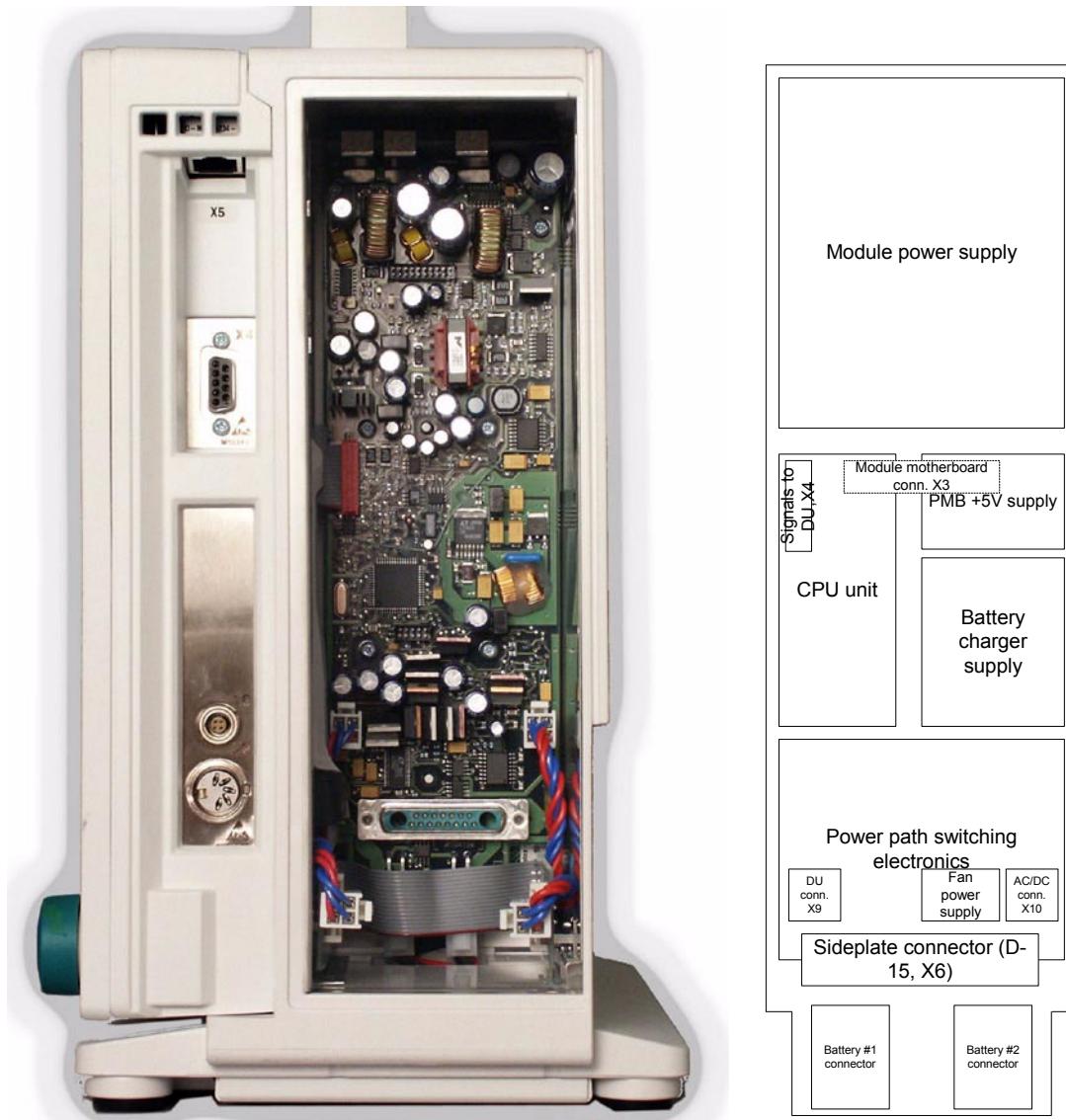
Figure 2   Location of the Power Management Board (side frame panel removed) and the PMB block diagram

The Power Management Board (PMB) is responsible for distributing DC current for the rest of the frame. The power source can be the AC/DC unit or one of the internal batteries, and the chosen power line is referred to as 'VBUS'. The voltage of VBUS is 10-17V. PMB also controls the fan voltage and battery charging.

The blocks in "Figure 2" represent different functions on the board.

Module power supply

This block generates the voltages needed for the parameter modules from the selected power source (VBUS), and delivers those to the module motherboard through connector X3. These voltages are +5V, +15V, -15V and +15Vdirty.

PMB CPU unit

The CPU unit controls all other functions of the board. The functions include:

- Battery current monitoring
- Battery capacity calculations
- Battery temperature monitoring
- Battery charger control
- Frame fan voltage control
- Level-change of recorder serial line signals
- Module power supply measurements (voltages & input current)
- Module power supply start-up and shutdown
- Power path management (choosing the correct supply source)
- Monitor start-up and shutdown control

PMB +5V supply

This unit provides the PMB CPU and other PMB electronics +5V power supply. Input either internal battery or AC/DC output, output +5V.

Battery charger supply

The charger generates the desired charge current for the batteries from the AC/DC output voltage. At fast charge rate the current is 1A, at timed charge the current is 500mA for 1/3rd of the time and at trickle charge rate the current is 500mA for 7/500th of the time. The charge rate is controlled by the CPU block.

Power path switching electronics

The power source to be used (batteries or AC/DC output) is chosen initially by a 'power path controller' inside this block. The CPU unit has full control over the power path management after the initial choice is made at start-up. In addition to the power path, the charge current path is also chosen by the CPU and driven by the power path controller.

WARNING **For as long as the AC/DC unit or either one of the two internal batteries is connected, the open metal surfaces in this area contain approximately 15V voltages. An accidental touch of a screwdriver or anything else conductive may short-circuit the power lines and destroy PMB electronics.**

Frame fan power supply

This unit drives the fan (mounted in the side frame unit). It is controlled by the CPU unit, and driven according to AC/DC current information and frame temperature.

2.4   Module motherboard

The module motherboard routes signals from the PMB to the module slots. Signals include power supplies and module data buses.

2.5   AC/DC Power Supply Unit

The universal AC/DC power supply provides an isolated 15.5 V supply for the S/5 Compact Monitor. The power unit is attached to the Frame Unit by four screws and a power-D25 connector.

The cooling air for the AC/DC unit is from the Frame Unit fan through cooling holes in the Frame Unit back plate. The power unit generates a load signal, which is read by the PMB board in the Frame Unit.

The AC/DC power supply is protected by an overvoltage protection. If the output voltage increases over 17V, the protection is activated and the AC/DC power supply unit does not return to normal operation until the power cord is briefly disconnected.

2.6   Batteries

There are two NiMH batteries attached to the bottom of the Frame Unit. The PMB board connects one of the batteries to be the power source, if no power is received from the AC/DC power supply.

The battery charging is controlled by PMB. The normal charge current for the batteries is 170mA RMS. When the batteries are full, the charging is continued by a 10mA current (trickle charge) to avoid self-discharge of the batteries.

2.7   Frame Unit Fan

The Frame Unit Fan is used for cooling the Frame Unit electronics, the modules and the AC/DC power unit. The fan is controlled by the PMB. The rotation speed of the fan is adjusted according to the frame temperature and AC/DC power unit load. At monitor start-up, the fan is briefly run at full speed to ensure its operation.

2.8   In-built Recorder Unit

The recorder unit is located in the Side Frame Unit, and it is connected to the Connector Board PMB-REC with a small connector board and 12-pin flex-strip cable.

External Communication

Communication with the monitor Central Processing Board takes place via the Connector Board PMB-REC, PMB, the Connector Board to Display Unit and the Display Unit DC/DC power unit.

The communication uses +5 V CMOS level RS232 serial interface with an RS485 reset.

Reset   The differential RS485 reset from the module bus generates a Recorder Unit reset signal on the Recorder Board. The Recorder Board also generates a power-up-reset, whose time constant is approximately 0.1 second. The Recorder Unit reset signal is therefore active when either the Module Bus RS485-reset or the power-up-reset is active.

+5 V priority   The recorder unit supply voltage, +15 VREC is switched on after +5 V is present.

2.9 Connectors and signals

Module motherboard

Table 1   **Module connector pinout (X1-X4):**

25 pin male D-connector	Pin No.	Signal
	1	Reset_485
	2	-15V
	3	15Vdirty
	4	+15V
	5	Data_485_
	6	Data_485
	7	GND
	8	Reset_485_
	9	CTSB
	10	RTSB
	11	RXDB
	12	TXDB
	13	GND
	14	NC
	15	GND
	16	CTSC
	17	RTSC
	18	RXDC
	19	TXDC
	20	NC
	21	PWM_ECG
	22	RXD_RS232
	23	TXD_RS232
	24	+5V
	25	+5V

2.9.1 External Connectors

Table 2   Network Connector, X5

RJ45 connector	Pin No.	Signal
	1	Tx +
	2	Tx -
	3	Rx +
	4	N/C
	5	N/C
	6	Rx -
	7	N/C
	8	N/C

Table 3   Coding element connector, X4

9 pin female D-connector	Pin No.	Signal
	1	IDCS1 (chip select)
	2	IDCL (clock)
	3	IDDI (data in)
	4	IDDO (data out)
	5	IDPE (protect enable)
	6	+5Vdc
	7	Direct ECG
	8	Nurse call
	9	GND

Table 4   RS232 Serial data connector X11

9 pin male D-connector	Pin No.	Signal
	1	GND
	2	RxD
	3	TxD
	4	NC
	5	GND
	6	N/C
	7	RTS
	8	CTS
	9	N/C

For information about S/5 Compact Monitor external connectors see this manual, Part II Slot I "Display Unit".

2.9.2   Serial Data Interface

The Serial Data Interface connector is a 9-pin male D-connector (X3) on the side of the AC/DC power unit.

The serial interface is an asyncronous RS-232 connection which uses hardware flow control. The communication speed is 115.2 kbps. The communication uses the following parameters: Parity None, Data bits 8 and Stop bits 1.

For more information about the S/5 Compact Monitor serial data interface see also this manual, Part II Slot I "Display Unit".

3 Service procedures

3.1 General service information

The field service of the S/5 Compact Anesthesia Monitor and S/5 Compact Critical Care Monitor is limited to replacing faulty PC boards and mechanical parts. Return the faulty PC boards to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed fault description.

CAUTION   Only trained personnel with appropriate tools and equipment shall perform the tests and repairs outlined in this section. Unauthorized service may void the warranty of the unit.

3.2 Service check

S/5 Compact Anesthesia Monitor, F-CM(REC)1
S/5 Compact Critical Care Monitor, F-CMC(REC)1

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check list should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Power cord		
Screwdrivers		
Multiparameter hemodynamic module		

3.2.2 Recommended parts

Part	Order No.	Notes
Frame Unit Fan filter	896085	
Recorder paper	74205	for recorder unit

3.2.3   Before beginning

- Make sure that the monitor is switched to standby.

- Disconnect the power cord and press the service reset switch until the LED next to it turns off.

- If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable. Take out any memory cards, if installed.

- Remove the AC/DC Power Unit.

- Disassemble the Side Frame Unit.

- Detach the battery cables from the Power Management Board.

3.2.4   Visual inspection

1. Side Frame Unit

    Check the Side Frame Unit:

    - screws are tightened properly

    - cables are connected properly

    - connectors are clean and intact

    ✍

2. PMB and the Connector Boards

    Check the Frame Unit from inside. Check the PMB and the Connector Boards:

    - there are no loose objects inside the Frame Unit

    - all screws are tightened properly

    - all connectors are clean and intact

    - cables are connected properly

    ✍

3. Frame Unit reattached

    Reconnect the battery cable.

    Reattach the Side Frame Unit.

    Reattach the Frame Unit back plate.

    Reattach the AC/DC power unit.

    ✍

    NOTE: Make sure that all insulation plates are placed correctly before reattaching the rear cover.

4. Battery slot

    Internal parts under bottom cover

    Detach the bottom cover and check internal parts:

    - the battery cable is connected properly

    - the batteries are properly in place

     •   there are no loose objects inside the battery slot

Reattach the bottom cover.

5.   External parts

Check external parts:

     •   the four rubber pads under the monitor are all in place

     •   all stickers are intact

     •   the Display Unit is attached properly

     •   all mechanical parts are functioning properly

     •   the service reset switch is intact

     •   the handle is attached properly

     •   the monitor frame is intact

6.   Module connections

Check that the module in use goes in smoothly and locks up properly in both module slots.

Leave the module connected.

7.   Fan filter

Clean or replace the Frame Unit Fan filter.

8.   Recorder

Clean the recorder unit, if installed:

Open the paper compartment cover and take out the paper roll.

Clean the paper compartment off of possible paper chaff.

Clean the thermal printhead and the small glass window before the static brush with a cotton swab dipped in isopropyl alcohol. Avoid contact with the rubber paper roller.

NOTE: Be careful to limit the application of alcohol to the thermal printhead and the window.

Attach a new paper roll into the recorder and close the cover.

9.   Primary fuses

Disconnect the primary fuse holder. Check that:

     •   the fuse compartment, the fuse holder and the fuses are clean and intact

     •   the fuses are of the correct rating

Reconnect the fuse holder and check that it locks up properly.

✍

3.2.5   Functional inspection

10. Stand-by LEDs

Connect the power cord.

Check that the standby LED starts blinking.

Check that the fan starts running.

✍

11. Start-up

Switch the monitor on.

Check that the monitor starts up properly, i.e. the alarm LEDs turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears.

No error messages should appear on the screen.

✍

12. Module recognition

Configure the monitor screen so that all the needed parameter information is shown:

Monitor Setup
> *Screen 1 Setup*
> > *Waveform Fields*
> > *Digit Fields*

Check that the selected parameter information is shown on the screen.

NOTE: InvBP waveforms are not shown until without a patient simulator. Do no connect the simulator to the monitor at this stage.

✍

13. Main software

Enter the service menu:

Monitor Setup
Install/Service (Password 16-4-34)
> *Service* (Password 26-23-8)

Take down the information regarding Power Management Board software and Battery.

✍

14. Content of service log

    Select ***Service Log*** from the menu. Check the contents of the Service Log for possible problems. If the monitor contains the recorder unit, record the Service Log on the recorder by selecting ***Record Log***.

    ✍

15. Voltages

    Check the power supply unit output voltages through the service menu:

    Monitor Setup
       Install/Service (Password 16-4-34)
          Service (password 26-23-8)
            Frame
             Power Supply

    The output voltages should meet the following ranges:

+15 V	14.50...15.50 V
-15 V	-14.50...-15.50 V
+15 VD	14.50...15.50 V
+5 V	4.80...5.30 V
VBUS	10.00...17.00 V
+12 V	11.50...12.50 V
+3.3 V	3.00...3.60 V
VBUS	10.00...17.00 V

    Preset monitor settings:

    Record/Print
       Record Waveforms
          Waveform 1 --> ecg1
          Waveform 2 --> p1
          Waveform 3 --> p2
          Delay --> Off
          Paper Speed --> 6.25 mm/s
          Length --> 30 s

16. Module communication

    Connect a patient simulator to the module.

    Enter the ***ESTP : ECG*** service menu:

    Monitor Setup
       Install/Service (Password 16-4-34)
          Service (password 26-23-8)
            Parameters
             ESTP : ECG

    Check that the Timeouts, Bad checksums and Bad c-s by mod values do not increase faster than by 5 per second.

Change the module into the other slot. When the module is recognized, check that the values do not still increase faster than by 5 per second.

☞

17. Battery voltage

    Enter the ***Battery*** service menu:

    Monitor Setup
    Install/Service (password 16-4-34)
        Service (password 26-23-8)
          Frame
            Power Supply
              Battery

    Check that the shown Battery Voltage value is within 10 – 14V.

☞

18. Monitor temperature

    Check that the shown Monit Temp value is within 20 - 40.

☞

19. Battery operation

    Disconnect the power cord (without switching the monitor to standby).

    Check that the monitoring continues normally. The battery indicator should appear on the upper right hand corner of the screen.

☞

20. Mains power recognition

    Reconnect the power cord.

    Check that the LCD display screen brightness increases back to normal and the monitoring continues without problems. The battery indicator should be replaced by the text CHARGE.

☞

3.2.6   Recorder Unit

21. Recorder messages

    Open the recorder unit cover.

    Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.

☞

22.	Recording

	Press the key **Record Wave** and check that the module starts recording the selected waveforms. Press the key **Stop** on the module to stop recording.

NOTE: InvBP waveforms are not recorded without a patient simulator.

NOTE: If no recording appears, check that the paper roll is installed in a correct way. Only one side of the paper is printable.

23.	Paper speed

	Press the key **Record Wave** again and this time wait until the recording stops. Check that the length of the recorded waveform scale is 18.7 cm (1.5 cm).

	Change the paper speed setting to 1 mm/s:

	Record/Print
	Record Waveforms
			Paper Speed --> 1 mm/s

	Press the key **Record Wave** and wait until the recording stops. Check that the length of the scale is now 3.0 cm (± 0.5 cm).

24.	Quality of recording

	Check that the quality of the recordings is acceptable.

## 3.2.7	General

25.	Service reset switch

	Check the service reset switch.

	Switch the monitor to standby and disconnect the power cord. Press the service reset switch for at least five seconds. Check that the LED next to the switch turns off, and also the fan turns off.

	Reconnect the power cord and turn the monitor back on. Check that all trends have now been erased.

26.	Battery capacity

	Typical lifetime of the Compact Monitor Ni-MH batteries is approximately 4 years.

	Test the batteries by performing the following:

- detach all modules

- keep the monitor connected to the mains power until the batteries are fully charged

- install a hemodynamic multiparameter module and disconnect the power cord

- notice the time the monitor stays on with batteries

Replace the batteries, if the time was less than 45 minutes.

✍

27. Battery charging

Reconnect the power cord, switch the monitor on and enter the **Battery** service menu:
Monitor Setup
        Install/Service (Password 16-4-34)
                Service (Password 26-23-8)
                        Frame
                              Power Supply
                                  Battery

Check that the monitor starts charging one of the batteries and all data is reasonable.

✍

28. Service Log reset

Enter the **Service Log** in the service menu:

Monitor Setup
        Install/Service (Password 16-4-34)
                Service (Password 26-23-8)
                        Service Log

Clear the content of the Service Log by selecting **Reset Log** in the menu.

✍

29. Electrical safety check

Perform an electrical safety check and a leakage current test.

Check that the monitor functions normally after the performed electrical safety check.

✍

30. Final cleaning

Switch the monitor to standby, disconnect the power cord and perform final cleaning.

After cleaning, reconnect the power cord for recharging the batteries.

✍

- Fill in all necessary documents.

3.3   Disassembly and reassembly

WARNING   **The S/5 Compact Monitor is always energized by an internal battery. A short circuit may cause internal damage. Do not touch any exposed wiring or conductive surface inside, as this may cause an electric shock.**

See the exploded view of the S/5 Compact Monitor Frame Unit in the 'Spare Parts' slot to get quick unerstaning of the structure.

3.3.1   To remove the batteries

1.   Open the Bottom Plate of the Frame Unit by opening the eight screws.
2.   Detach the battery cables and remove the batteries.

NOTE: Remember the order of the batteries connected to the PMB board.

3.3.2   To remove the AC/DC Unit

1.   Open the four screws holding the unit at the back of the Compact Monitor .
2.   Pull the AC/DC Unit carefully to avoid damaging the connector.

NOTE: It is not allowed to repair the AC/DC power unit in the field.
Return the faulty AC/DC power unit to GE Healthcare for service.

3.3.3   To disassemble the Side Frame Unit

1.   Detach/remove the AC/DC Unit.
2.   Open the three screws from the left side of the Frame Unit back plate.
3.   Loosen the long screw at the upper left corner of the Frame Unit.
4.   Open the two screws at the bottom left side of the Frame Unit.
5.   Pull the Side Panel Unit carefully from the connector to the PMB Board and out of the frame.

NOTE: When reassembling the Side Panel Unit, be careful not to damage the components on the PMB Board.

3.3.4   To detach/remove the PMB Board (Power Managemet Board)

NOTE: It is important to remove the batteries before starting to remove the PMB Board!

NOTE: Remember the order of batteries connected to the PMB Board.

1.   Disassemble the Side Panel Unit.
2.   Open the Bottom Plate of the Frame Unit by opening the eight screws and remove the batteries.
3.   Open the two screws holding the connector to the AC/DC Unit.
4.   Open the two screws holding the connector to the Display Unit.
5.   Detach the Power and Data cables from the PMB Board.
6.   Open the eight screws holding the PMB Board.
7.   Pull the PMB Board carefully to detach it from the Module Mother Board.

3.3.5   To detach/remove the Module Mother Board

1.   Detach/remove the PMB Board.

2.   Unscrew the spacers to remove the Module Mother Board.

NOTE: Be carefull not to damage the service reset switch.

3.3.6   To remove the Recorder Unit

Disassemble the Side Frame Unit.

Loosen the screws and extract the recorder.

3.3.7   Adjustment and Calibrations

It is not necessary to perform calibrations or adjustments on the Compact Monitor Frame Unit.

3.4   Internal battery

WARNING   **The S/5 Compact Monitor is always energized by an internal battery. A short circuit may cause internal damage. Do not touch any exposed wiring or conductive surface inside, as this may cause an electric shock.**

The monitor can be run either on mains power or on internal battery. Battery operation is initiated when the power cord is disconnected or when the mains power is lost during monitoring.

The internal battery capacity is up to 2.5 hours with fully charged batteries.

NOTE: Before using the monitor for the first time, charge the battery to its full capacity (charging time 10 hours).

3.4.1   Battery time

A symbol on the monitor screen indicates the remaining operating time of the battery.

When about 10 minutes of battery operating time is left, a 'Batt low' alarm is activated and the monitor makes one beep.

When about two minutes of operating time is left, a new alarm 'Batt empty' is activated.

3.4.2   Refreshing the batteries

The battery is automatically charged when the monitor is connected to mains power. Charging the battery depends on the discharge level of the battery. Battery charging time is ten hours to full capacity.

If the monitor is used mainly with the mains power, refresh the battery by charging and discharging the battery completely once a month to slow down loss of battery capacity.

NOTE: If the monitor is used for frequent short transportation, refresh the batteries every two weeks and replace the batteries every six months.

To refresh:

1.   Connect the monitor power cord to power outlet for at least ten hours.

2.   Remove the power cord, and turn on the monitor and let it turn off by itself (it takes about 1.5 hours). Wait for 15 minutes.

3.   Reconnect the power cord to power outlet and charge the battery for at least ten hours.

NOTE: Inadequate maintenance will decrease the battery capacity and the monitor's operation time on batteries.

When charging, a charging symbol is displayed.

During battery charging, the standby led is blinking. It lights up when the batteries are fully charged.

3.4.3 Replacing the batteries

1. Open the Bottom Plate of the Frame Unit by opening the eight screws.
2. Detach the battery cables and remove the batteries.
3. Insert new batteries and connect the battery cables.

NOTE: Remember the order of the batteries connected to the PMB board.

4 Troubleshooting

For troubleshooting, see also section "Display Unit: Troubleshooting" in this manual.

4.1 General

Trouble	Cause	What to do
Monitor is not starting	1. **On/Stby** key pressed too long. 2. The batteries are empty. 3. If power cord connected. If the On/Stby LED is lit or blinks. AC/DC power unit may be faulty. 4. If the Frame unit fan is running. If AC/DC power unit is working, the PMB in the Frame Unit may be faulty. 5. **On/Stby** key may be faulty.	1. **On/Stby** key may be pressed for less than 10 s. 2. Connect the power cord. 3. Replace the AC/DC power unit. 4. Replace the PMB. 5. Replace the Display Unit side panel keyboard foil.
Monitor is not starting, the Frame Unit back panel LED is lit.	1. The connection between Frame Unit and Display Unit may be faulty. 2. Display Unit voltages are not OK. 3. Faulty Central Processing Board.	1. Check the connector and the cables between Display Unit and Frame Unit. 2. Replace the Display Unit DC/DC power board. 3. Replace the Central Processing Board.
The monitor starts (Frame Unit back panel LED is lit and a beep is heard), but the display remains black.	1. The LCD display cables are loose. 2. The backlights are not lit.	1. Check the LCD cables and connectors on the Central Processing Board and in the Front Unit. 2.Connector Board cable may be loose. Check the cable. Backlights may be faulty. Replace them. Backlight inverter may be faulty. Replace the inverter.
Module data disappears from the screen.	Parameter module current (in PMB) too high.	Detach and change the parameter module. PMB module power section may be faulty. Replace the PMB.
Keyboard not working, but module communication is OK.	Keyboard cables and connectors, or Connector Board cable and connector may be faulty.	Check the Connector Board cable and connector. Check the keyboard cable connection to the connector board.

Trouble	Cause	What to do
Keyboard not working, and module communication not working.	UPI section of the Central Processing Unit not functioning normally.	Restart the monitor. Replace the Central Processing Board.
Keyboard partly not working.	Keyboard faulty.	Replace the keyboard foil.
	Connector Board faulty	Replace the Connector Board.
'Display temperature high' and 'Check dust filter' messages.	The temperature inside the display unit has been more than 55 °C for two minutes at the minimum.	Check and change the dust filter if necessary.
'Battery failure' message on the display.	1. Problem in communication between Display Unit and Frame Unit (the PMB serial number and other data faulty in Service View). 2. PMB in Frame Unit may be faulty.	1. Check the connectors and cables between Display Unit and Frame Unit. 2. Replace the PMB.
'Frame temperature high' and 'Check dust filter' messages.	The temperature inside the frame is more than 55 °C.	Check and change the dust filters if necessary.
'Battery temperature high' and 'Check dust filter' messages.	The temperature of the batteries is more than 53 °C.	Check and change the dust filters if necessary.
Display Unit is too warm.	1. Display Unit Fan is not working.	1. Check the Fan cable is connected to the correct connector.
Recorder is not working properly.	1. Recorder communication problem. 2. Problem in voltages in Frame Unit.	1. Check the connectors and cables between Display Unit and Frame Unit. 2. Check the Frame Unit voltages from the service menu. If not OK, replace the PMB.
After shut down, the trend and patient data does not remain 15 min in the memory.	1. The On/Stby switch has been pressed for over 10 s. (= service reset) 2. Faulty PMB.	1. When switching off, the On/Stby switch has to be pressed for less than 10 s. 2. Replace the PMB.

4.2 Recorder Unit

4.2.1 Troubleshooting chart

Problem	Cause	What to do
Recorder will not start. No error messages shown.	Connector board loose.	Check connector board connections.
	Recorder board faulty.	Replace the recorder board.
	Recorder unit faulty.	Replace the recorder unit.
Recorder works but nothing appears on the paper.	Active side of the paper downwards.	Turn the paper roll over. To test which side is active: Place the paper on a hard surface and draw a line with a fingernail - a dark line will appear on the active (thermal) side.
	Recorder unit faulty.	Replace the recorder unit.

Message	Explanation
Recorder: out of paper	Release paper jam or insert a roll of paper into the recorder.
Recorder: cover open	Close the recorder cover correctly.
Recorder: thermal array overheat	Recorder overheated. Stop using and allow it to cool down.
Recorder: input voltage low	+15 Vrec is too low. Check the connectors and connector board.
Recorder: input voltage high	+15 Vrec is too high. Check the connectors and connector board.
Recorder system error 1, 2, 3	System error. If the problem persists, replace the recorder unit.
Recorder: module removed	A communication error due to a fault in the recorder or in the Central Processing Board.

5 Earlier revisions

This manual covers the earlier revisions of the S/5 Compact Anesthesia Monitor or S/5 Compact Critical Care Monitor.

APPENDIX A   Service check form, S/5 Compact Anesthesia Monitor, S/5 Compact Critical Care Monitor

Customer		
Service	Module type	S/N
Service engineer		Date

Monitor Installation			
F-	E-	E-	
S-	E-	M-	
L-	M-	N-	

OK = Test OK   **N.A. = Test not applicable**   **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Side Frame Unit	☐	☐	☐	2. PMB and the Connector Boards	☐	☐	☐
3. Frame Unit reattached	☐	☐	☐	4. Battery slot	☐	☐	☐
5. External parts	☐	☐	☐	6. Module connections	☐	☐	☐
7. Fan filter	☐	☐	☐	8. Recorder	☐	☐	☐
9. Primary fuses	☐	☐	☐	10. Stand-by LEDs	☐	☐	☐
11. Start-up	☐	☐	☐	12. Module recognition	☐	☐	☐
13. Main software	L-			Power Management board software			
14. Content of service log	☐	☐	☐				
Notes							

15. Voltages		
+15 V		14.50...15.50 V
-15V		-14.50...-15.50 V
+15VD		14.50...15.50 V
+5V		4.80...5.30 V
VBUS		10.00...17.00V
+12V		11.50...12.50V
+3.3 V		3.00...3.60V
VBUS		10.00...17.00V

	OK	N.A.	Fail
16. Module communication	☐	☐	☐

17. Battery voltage		10...17 V
18. Monitor temperature		20...40 C

19. Battery operation	☐ ☐ ☐	20. Mains power recognition	☐ ☐ ☐

Notes

Recorder unit

	OK	N.A.	Fail		OK	N.A.	Fail
21. Recorder messages	☐	☐	☐	22. Recording	☐	☐	☐
23. Paper speed	☐	☐	☐	24. Quality of recording	☐	☐	☐

Notes

General

	OK	N.A.	Fail		OK	N.A.	Fail
25. Service reset switch	☐	☐	☐	26. Battery capacity	☐	☐	☐
27. Battery charging	☐	☐	☐	28. Service Log reset	☐	☐	☐
29. Electrical safety check	☐	☐	☐	30. Final cleaning	☐	☐	☐

Notes

Used spare parts			

Signature

For your notes:

Datex-Ohmeda

S/5^{TM} Compact Anesthesia Monitor
S/5^{TM} Compact Critical Care Monitor

Spare Parts
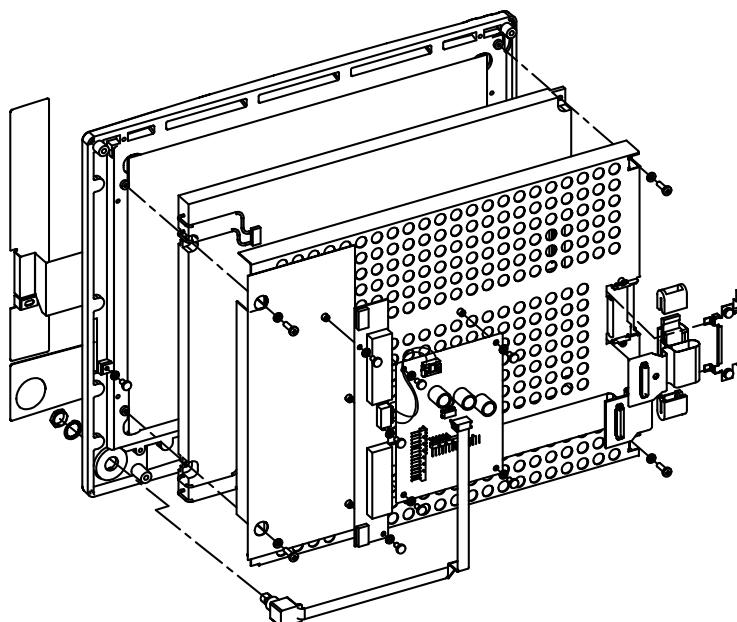
All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.

Outside the USA, check local laws for any restriction that may apply.

M1031521
March, 2006

Table of contents

1   S/5 Compact Monitor Display Unit

1.1   F-CM(C)REC1 rev. 00, 01, F-CM(C)1 rev.00...04

Figure 1   Exploded view of the Display Unit and labels

Item	Description	Order No.	Replaced by
4	Cross cyl. head screw M3x6 tufflock	617210	
9	Side Panel sticker, DA; F-CM1; S/5	898080	
9	Side Panel sticker, DE; F-CM1; S/5	898071	
9	Side Panel sticker, EN; F-CM1; S/5	895764	
9	Side Panel sticker, ES; F-CM1; S/5	898074	
9	Side Panel sticker, FI; F-CM1; S/5	898077	
9	Side Panel sticker, FR; F-CM1; S/5	898072	
9	Side Panel sticker, HU; F-CM1; S/5	M1042448	
9	Side Panel sticker, IT; F-CM1; S/5	898075	
9	Side Panel sticker, JA; F-CM1; S/5	898081	
9	Side Panel sticker, NL; F-CM1; S/5	898073	

Item	Description	Order No.	Replaced by
9	Side Panel sticker, NO; F-CM1; S/5	898079	
9	Side Panel sticker, PL; F-CM1; S/5	8003506	
9	Side Panel sticker, PT; F-CM1; S/5	898076	
9	Side Panel sticker, SV; F-CM1; S/5	898078	
10	Front Panel sticker, DA; F-CMC1; S/5	898304	
10	Front Panel sticker, DE; F-CMC1; S/5	898295	
10	Front Panel sticker, EN; F-CMC1; S/5	898294	
10	Front Panel sticker, ES; F-CMC1; S/5	898298	
10	Front Panel sticker, FI; F-CMC1; S/5	898301	
10	Front Panel sticker, FR; F-CMC1; S/5	898296	
10	Front Panel sticker, HU; F-CMC1; S/5	M1042413	
10	Front Panel sticker, IT; F-CMC1; S/5	898299	
10	Front Panel sticker, JA; F-CMC1; S/5	898305	
10	Front Panel sticker, NL; F-CMC1; S/5	898297	
10	Front Panel sticker, NO; F-CMC1; S/5	898303	
10	Front Panel sticker, PL; F-CMC1; S/5	8003509	
10	Front Panel sticker, PT; F-CMC1; S/5	898300	
10	Front Panel sticker, SV; F-CMC1; S/5	898302	
10	Front Panel sticker, DA; F-CM1; S/5	898068	
10	Front Panel sticker, DE; F-CM1; S/5	898059	
10	Front Panel sticker, EN; F-CM1; S/5	895763	
10	Front Panel sticker, ES; F-CM1; S/5	898062	
10	Front Panel sticker, FI; F-CM1; S/5	898065	
10	Front Panel sticker, FR; F-CM1; S/5	898060	
10	Front Panel sticker, HU; F-CM1; S/5	M1042413	
10	Front Panel sticker, IT; F-CM1; S/5	898063	
10	Front Panel sticker, JA; F-CM1; S/5	898069	
10	Front Panel sticker, NL; F-CM1; S/5	898061	
10	Front Panel sticker, NO; F-CM1; S/5	898067	
10	Front Panel sticker, PL; F-CM1; S/5	8003509	
10	Front Panel sticker, PT; F-CM1; S/5	898064	
10	Front Panel sticker, SV; F-CM1; S/5	898066	
11	Tooth washer	63615	

Item	Description	Order No.	Replaced by
12	Screw-cross rec.cylind.h. stzn,m4x40	61761	
31	ComWheel; S/5	898794	
33	Locking set, F-CM1, SPARE PART	8001522	
34	Filter capsule (DU fan), F-CM1	896089	
35	Filter (DU), F-CM1	897010	
36	LID for Card slots, F-CM1, SPARE PART	8001523	

1.1.1 Display unit, bottom unit, F-CM(C)REC1 rev. 00, 01, F-CM(C)1 rev.00...03
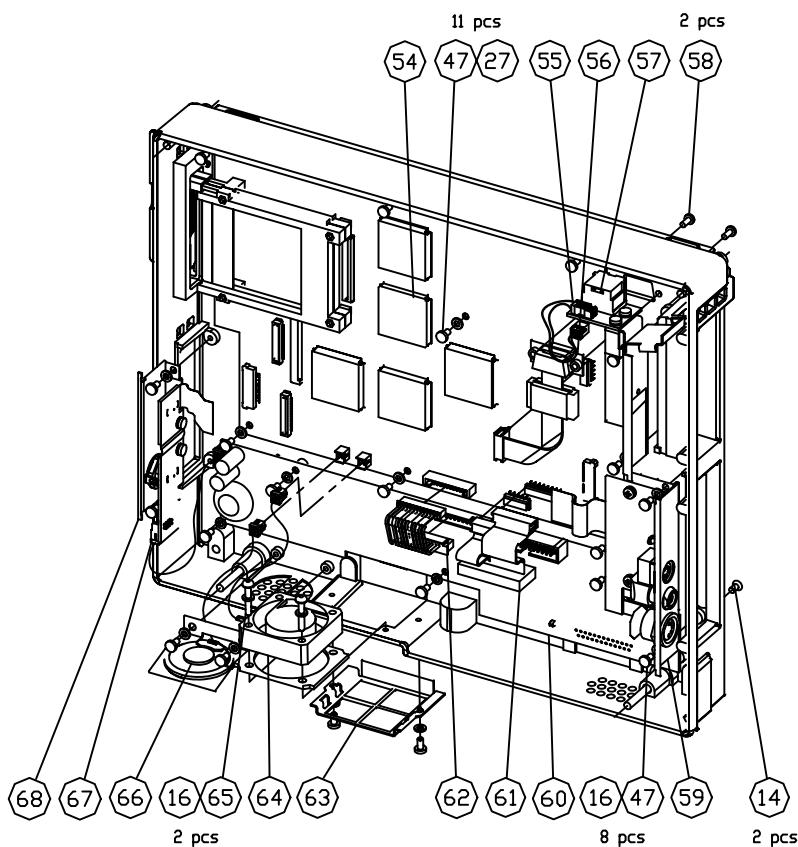
Figure 2 Exploded view of the Display Unit, bottom unit

Item	Description	Order No.	Replaced by
14	Screw-cross rec. c/s h, stzn, m3x6	61620	
16	Shakeproof washer m3.2	63611	
16	Shakeproof washer m3.2	63611	

Item	Description	Order No.	Replaced by
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
47	Cross cylinder-head screw M3x6	61721	
47	Cross cylinder-head screw M3x6	61721	
54	Central Processing Board, F-CM1	8000110	8001596
54	Central Processing Board, F-CM1	8001596	
55	NET cable, F-CM1	896527	
56	NET Smart key cable, F-CM1	896528	
57	Connector unit, NET, F-CM1	896102	
58	Cross recess screw UNC 4-40	61841	
59	Connector unit, SYNC, F-CM1	894914	M1029304
60	DC/DC-board, F-CM1	896705	
61	Central Processing Board-DC/DC SIGNAL CABLE, F-CM1	8000023	
62	Central Processing Board-DC/DC POWER CABLE, F-CM1	8000004	
63	Filter bracket (DU fan), F-CM1	896090	
64	Fan unit (DU), F-CM1	896555	
65	Cross cylinder head screw M3x18 FZB DIN7985	61739	
66	Loudspeaker unit, F-CM1	896109	
67	DIS power cable, F-CM1	8000007	
68	Connector unit, DIS, F-CM1	894912	

1.1.2 Display unit, bottom unit, F-CM(C)1 rev.04
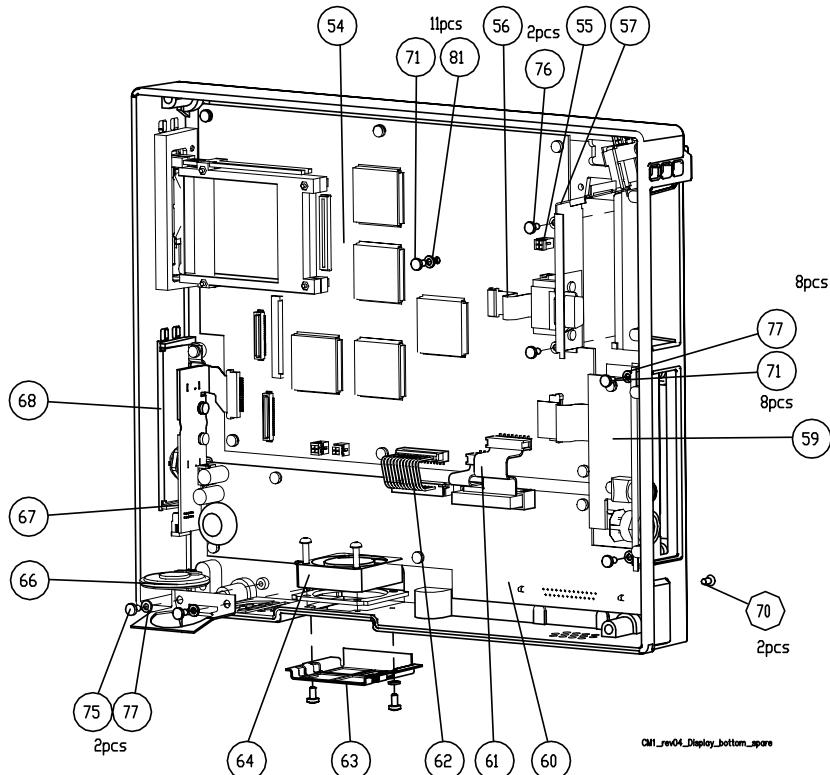
Figure 3   Exploded view of the Display Unit, bottom unit

Item	Description	Order No.	Replaced by
14	Screw-cross rec. c/s h, stzn, m3x6	61620	
16	Shakeproof washer m3.2	63611	
16	Shakeproof washer m3.2	63611	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
47	Cross cylinder-head screw M3x6	61721	
47	Cross cylinder-head screw M3x6	61721	
54	Central Processing Board, F-CM1	8000110	8001596
54	Central Processing Board, F-CM1	8001596	
55	NET cable, F-CM1	896527	
56	NET Smart key cable, F-CM1	896528	
57	Connector unit, NET, F-CM1	M1035234	
58	Cross recess screw UNC 4-40	61841	
59	Connector unit, SYNC, F-CM1	M1029304*	

Item	Description	Order No.	Replaced by
60	DC/DC-board, F-CM1	896705	
61	Central Processing Board-DC/DC SIGNAL CABLE, F-CM1	8000023	
62	Central Processing Board-DC/DC POWER CABLE, F-CM1	8000004	
63	Filter bracket (DU fan), F-CM1	896090	
64	Fan unit (DU), F-CM1	896555	
65	Cross cylinder head screw M3x18 FZB DIN7985	61739	
66	Loudspeaker unit, F-CM1	896109	
67	DIS power cable, F-CM1	8000007	
68	Connector unit, DIS, F-CM1	M1035235	
	* Not compatible with MRI use		

1.1.3 Front unit, F-CM(C)(REC)1 rev. 00
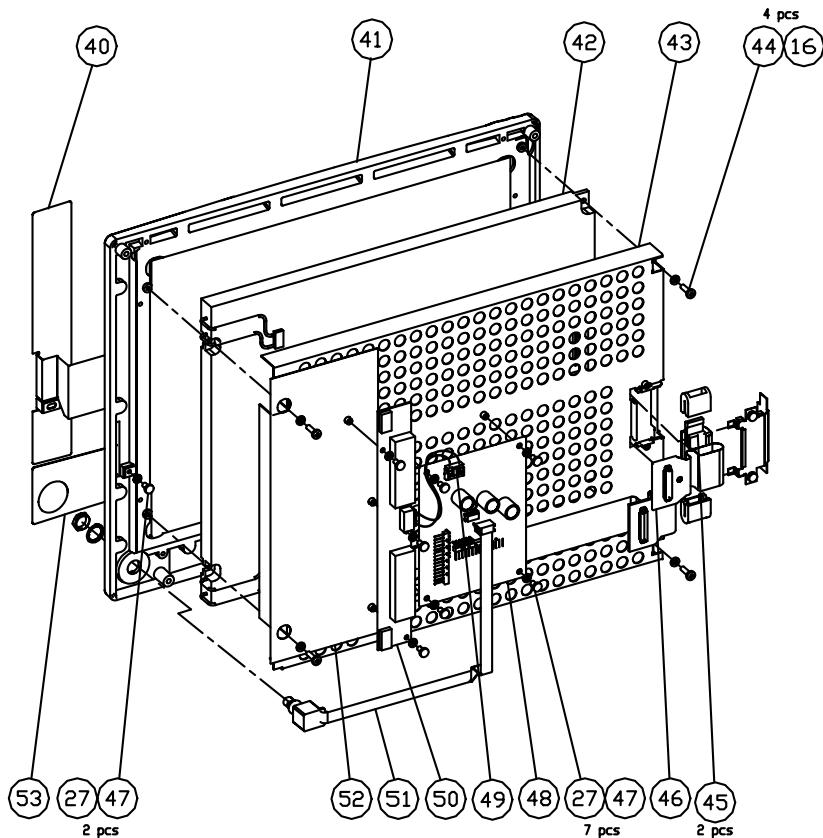
Figure 4   Exploded view of the Display Unit, Front Unit, F-CM(C)(REC)1 rev.00

Item	Description	Order No.	Replaced by
16	Shakeproof washer m3.2	63611	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
40	Membrane keyboard, VERT., F-CM1	895686	
41	Front cover for display unit, F-CM(C)(REC)1 Rev. 00	8004619	
42	Display-LCD, 12.1in. tft, svga	572793	
44	Screw-cross rec.cylind.h. stzn,m3x10	61735	
45	EMI-filter, split ferrite core for flat cable 26mm	304514	
46	Display cable board (SHARP), F-CM1	895446	
47	Cross cylinder-head screw M3x6	61721	
48	Connection board (DU), F-CM1	896465	
49	Inverter cable (SHARP), F-CM1	896565	
50	Display-inverter,12V 2x6mA for572793	572794	

Item	Description	Order No.	Replaced by
51	Opto-encoder, rotary switch, 16-postions, push button, plastic shaft, 10inch Ribbon cable and connector	113293	
52	Insulator for Invertter, F-CM1	894929	
53	Membrane keyboard, HORIS., F-CM1	895685	
	Complete front unit, F-CM1 rev.00	894908	

1.1.4 Front unit, F-CM(C)REC1 rev. 01, F-CM(C) rev.01, rev.02
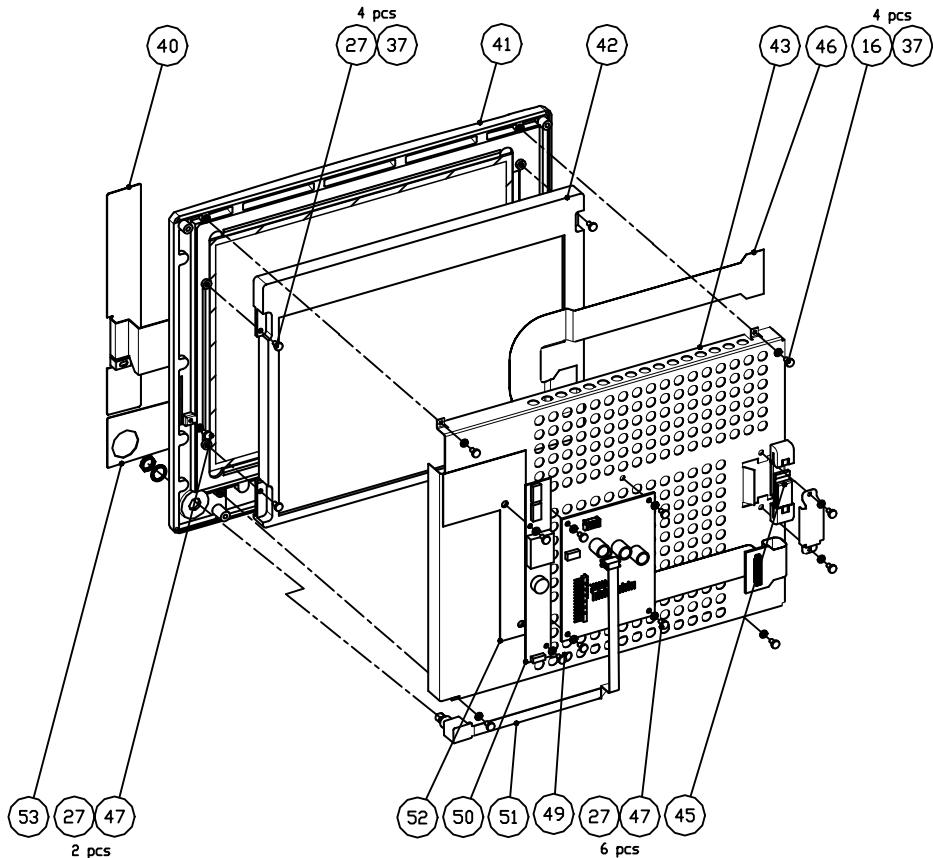
Figure 5   Exploded view of the Display Front Unit, F-CM(C)(REC)1 Rev.01, F-CM(C) rev 02

Item	Description	Order No.	Replaced by
16	Shakeproof washer m3.2	63611	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
37	Cross cylinder head screw M3x8	61722	
40	Membrane keyboard, VERT., F-CM1	895686	
41	Front cover for display unit, F-CM1 rev.01	8004620	
42	Display-LCD,	902673	* M1012542
43	EMC Cover (Display), F-CM1 rev.01	8003870	
44	Screw-cross rec.cylind.h. stzn,m3x10	61735	
45	EMI-filter, split ferrite core for flat cable 26mm	304514	
46	Display cable board, F-CM1 rev.01	8003727	
47	Cross cylinder-head screw M3x6	61721	
48	Connection board (DU), F-CM1	896465	
49	Invertter cable (SHARP), F-CM1 rev 01	8004022	

Item	Description	Order No.	Replaced by
50	12V inverter for LCD display (902673) M1012542	902674	M1013813
51	Opto-encoder, rotary switch, 16-postions, push button, plastic shaft, 10inch Ribbon cable and connector	113293	
52	Insulator for Invertter, F-CM(C)(REC)1...01	8004024	
53	Membrane keyboard, HORIS., F-CM1	895685	
	Complete front unit, F-CM1 rev.01	8004021	
	Backlight for display, F-CM1 rev.01	M1001013	
	* use together with inverter M1013813		

1.1.5   Front unit, F-CM(C) rev.03...04
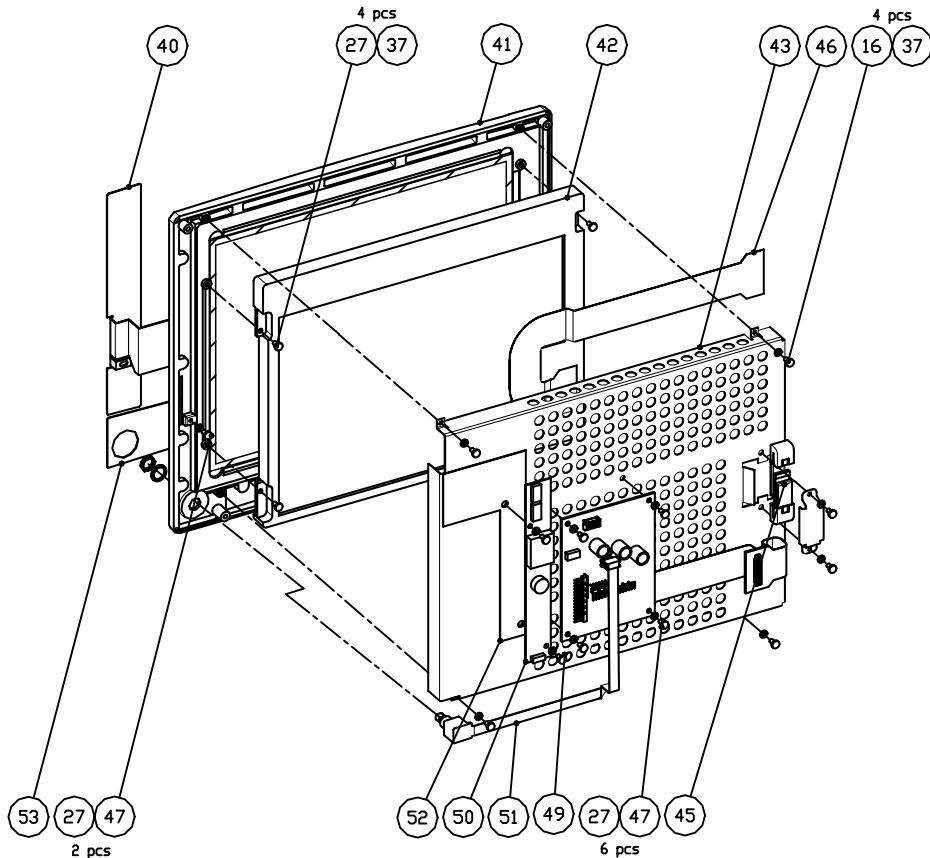
Figure 6   **Exploded view of the Display Front Unit, F-CM(C) rev 03...04**

Item	Description	Order No.	Replaced by
16	Shakeproof washer m3.2	63611	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
37	Cross cylinder head screw M3x8	61722	
40	Membrane keyboard, VERT., F-CM1	895686	
41	Front cover for display unit, F-CM1 rev.01	8004620	
42	Display-LCD,	M1012542	
43	EMC Cover (Display), F-CM1 rev.01	M1014033	
44	Screw-cross rec.cylind.h. stzn,m3x10	61735	
45	EMI-filter, split ferrite core for flat cable 26mm	304514	
46	Display cable board, F-CM1 rev.01	8003727	
47	Cross cylinder-head screw M3x6	61721	
48	Connection board (DU), F-CM1	896465	
49	Inverter cable (SHARP), F-CM1 rev 01	8004022	

Item	Description	Order No.	Replaced by
50	12V inverter for LCD display M1012542	M1013813	
51	Opto-encoder, rotary switch, 16-postions, push button, plastic shaft, 10inch Ribbon cable and connector	113293	
52	Insulator for Inverter, F-CM(C)(REC)1...01	8004024	
53	Membrane keyboard, HORIS., F-CM1	895685	
54	Wire clamp	M1015333	
	Complete front unit, F-CM1 rev.03	M1014753	
	Backlight for display, F-CM1 rev.03	M1014385	

1.1.6   Central Processing Board

Item	Item description	Order No.
-	Battery for SRAM/Timekeeper	197230

2   S/5 Compact Monitor Frame

2.1   F-CM(REC)1, F-CMC(REC)1 rev. 00
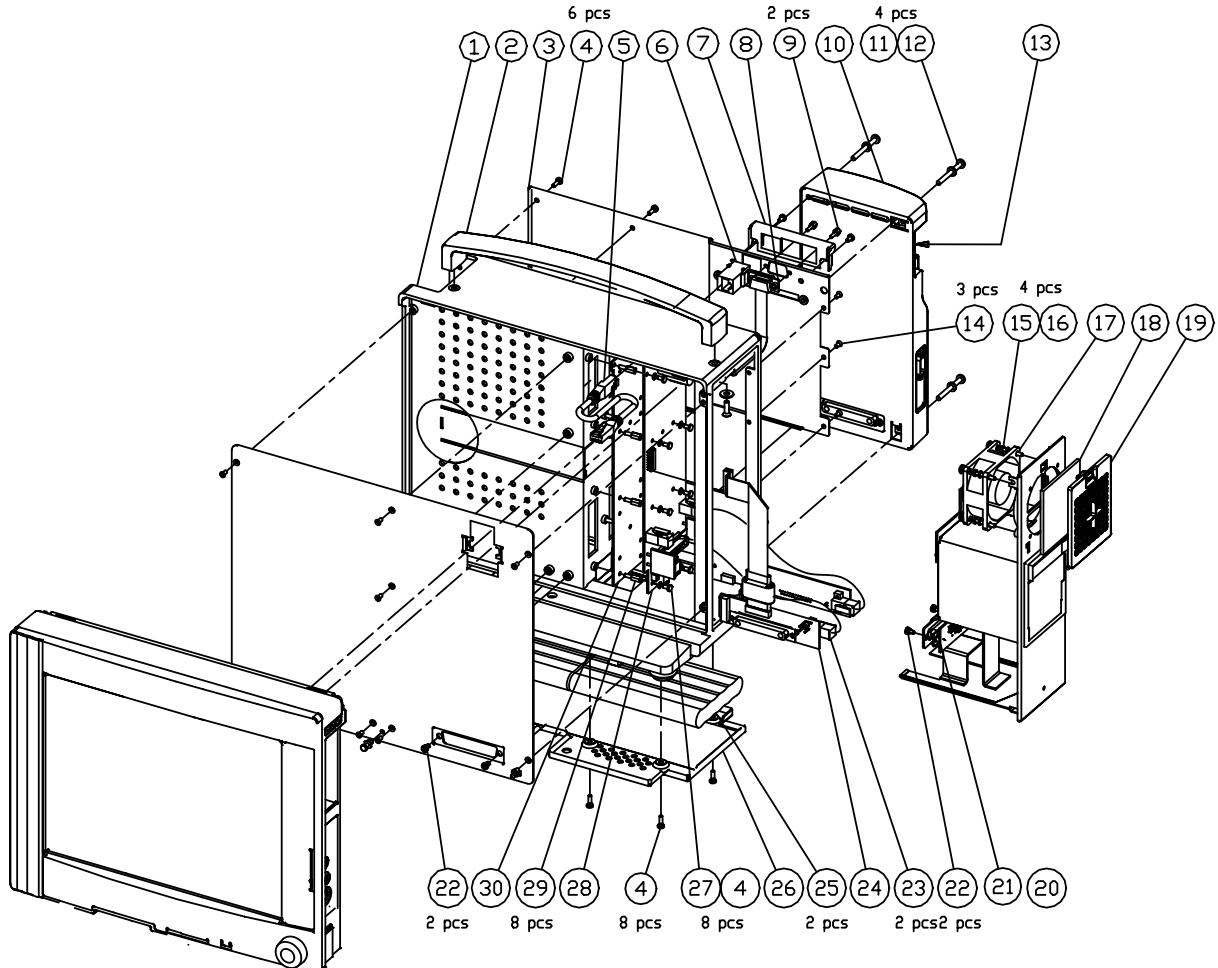
Figure 7   Exploded view of S/5 Compact Monitor Frame

Item	Description	Order No.	Replaced by
1	Frame assembly, F-CM1	896082	
2	Handle, F-CM1, SPARE PART	8001521	
3	Back plate (FRAME), F-CM1	896083	8004019
4	Cross cyl. head screw M3x6 tufflock	617210	
4	Cross cyl. head screw M3x6 tufflock	617210	
4	Cross cyl. head screw M3x6 tufflock	617210	
5	AIM-N-cable,Network connection cable, 0.23m,UTP T568A C5	908680	
6	Connector-case, modular coupler, 8-positon, in-line	548737	

Item	Description	Order No.	Replaced by
7	Connector shield, F-CM1	8000645	
8	NET smart key cable 2, F-CM1	8000701	
9	Block screw D-female	546096	
10	AC/DC Power supply, PFC,+15.5V,75W	90482	
11	Tooth washer	63615	
12	Screw-cross rec.cylind.h. stzn,m4x40	61761	
13	Fuse T2AH / 250V, 5x20mm	511200	
14	Screw-cross rec. c/s h, stzn, m3x6	61620	
15	Screw-cross rec.cylind.h. stzn,m3x20	61737	
16	Shakeproof washer m3.2	63611	
17	Fan unit (side), F-CM1	896564	
17	Fan unit (side), F-CM1	896564	
18	Filter (side fan), F-CM1	896085	
19	Filter bracket (side fan), F-CM1	896086	
20	Side frame unit, F-CMREC1 rev. 00 (recorder included)	895500	
21	Connector board PMB-REC, F-CM1	896894	
22	Screw of D25 connector, F-CM1	897531	
22	Screw of D25 connector, F-CM1	897531	
23	Power cable, F-CM1	898313	
24	PMB-connector board, F-CM1	898108	
25	Battery-NiMH,12V,3.5Ah,10x1.2V	17014	
26	Bottom plate, F-CM1	8001365	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
28	Power management board, F-CM1	896121	
29	Spacer, hexagon bar, M3X8,5AV5MSN	640459	
30	Module mother board, F-CM1	8000426	
32	FRONT PLATE (FRAME), F-CM1	896087	
	Recorder, Thermal plott.forREC,50,seril.76.8kB	90350	

2.2 S/5 Compact Monitor Frame, F-CM(C)1 rev. 01, rev. 02, rev. 03, F-CM(C)REC1 rev.01
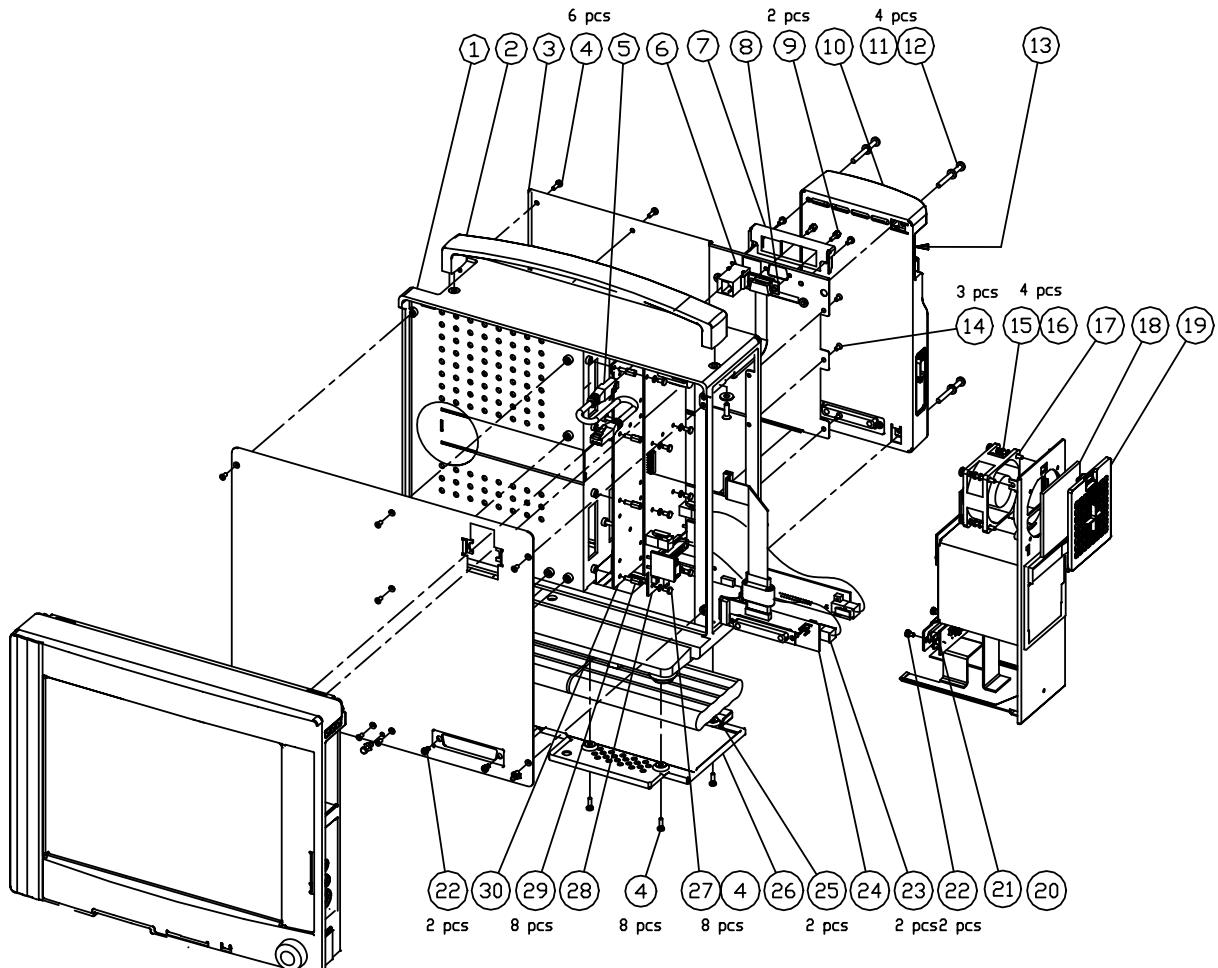
**Figure 8**   **Exploded view of S/5 Compact Monitor Frame**

Item	Description	Order No.	Replaced by
1	Frame assembly, F-CM1	896082	
2	Handle, F-CM1, SPARE PART	8001521	
3	Back plate (FRAME), F-CM1	8004019	
4	Cross cyl. head screw M3x6 tufflock	617210	
5	AIM-N-cable,Network connection cable, 0.23m,UTP T568A C5	908680	
6	Connector-case, modular coupler, 8-positon, in-line	548737	
7	Connector shield, F-CM1 rev. 01	8004290	
8	NET smart key cable 2, F-CM1	8000701	
9	Block screw D-female	546096	

| Item	Description	Order No.	Replaced by
10	AC/DC Power supply, PFC,+15.5V,75W	90482	
11	Tooth washer	63615	
12	Screw-cross rec.cylind.h. stzn,m4x40	61761	
13	Fuse T2AH / 250V, 5x20mm	511200	
14	Screw-cross rec. c/s h, stzn, m3x6	61620	
15	Screw-cross rec.cylind.h. stzn,m3x20	61737	
16	Shakeproof washer m3.2	63611	
17	Fan unit (side), F-CM1	896564	
18	Filter (side fan), F-CM1	896085	
19	Filter bracket (side fan), F-CM1	896086	
20	Side frame unit, F-CMREC1, rev. 01 (recorder included)	895500	
20	Side frame unit, F-CM1, rev. 02...03(recorder not included)	8005536	
21	Connector board PMB-REC, F-CM1	896894	
22	Screw of D25 connector, F-CM1	897531	
23	Power cable, F-CM1	898313	
24	PMB-connector board, F-CM1	898108	
25	Battery-NiMH,12V,3.5Ah,10x1.2V	17014	
26	Bottom plate, F-CM1	8001365	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
28	Power management board, F-CM1	8003808	8005308
29	Spacer, hexagon bar, M3X8,5AV5MSN	640459	
30	Module mother board, F-CM1	8000426	
32	FRONT PLATE (FRAME), F-CM1	896087	
	Recorder, Thermal plott.forREC,50,seril.76.8kB	90350	

2.3 Side frame unit, F-CM1, F-CMC1 rev.02, rev.03
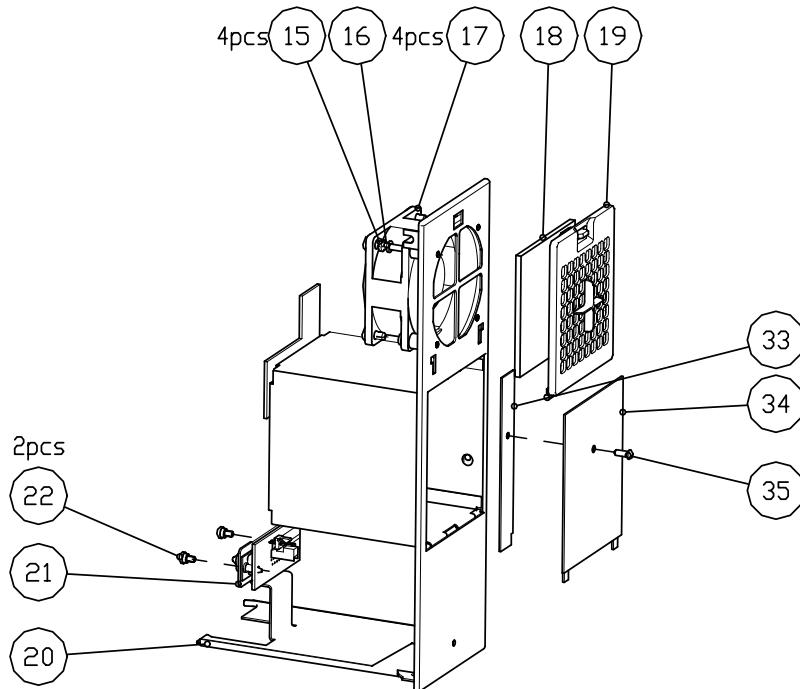
Figure 9   Exploded view of Side frame unit, F-CM(C)1 rev.02, rev.03

Item	Description	Order No.	Replaced by
15	Screw-cross rec.cylind.h. stzn,m3x20	61737	
16	Shakeproof washer m3.2	63611	
17	Fan unit (side), F-CM1	896564	
18	Filter (side fan), F-CM1	896085	
19	Filter bracket (side fan), F-CM1	896086	
20	Side frame unit, F-CM1 rev.02 (recorder not included)	8005536	
	Recorder, Thermal plott.forREC,50,seril.76.8kB	90350	
21	Connector board PMB-REC, F-CM1	896894	
22	Screw of D25 connector, F-CM1	897531	
33	Latch	8005503	
34	Protection plate 2	8005505	
35	Screw	885191	

2.4 S/5 Compact Monitor Frame, F-CM(C)1 rev. 04

CM1_frame_rev04_spare
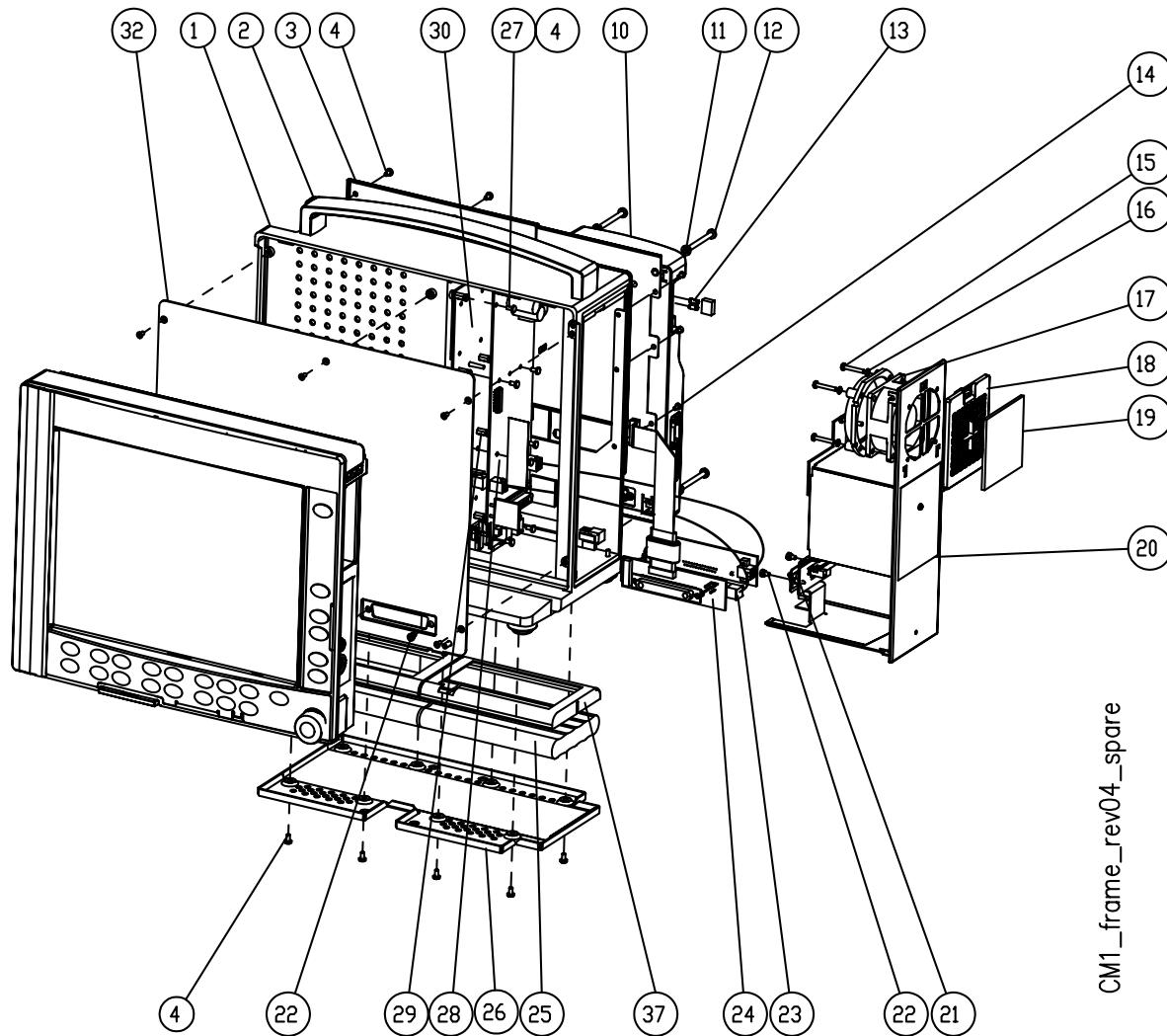
Figure 10   Exploded view of S/5 Compact Monitor Frame

Item	Description	Order No.	Replaced by
1	Frame assembly, F-CM1	896082	
2	Handle, F-CM1, SPARE PART	8001521	
3	Back plate (FRAME), F-CM1	8004019	
4	Cross cyl. head screw M3x6 tufflock	617210	
10	AC/DC Power supply, PFC,+15.5V,75W	90482	
11	Tooth washer	63615	
12	Screw-cross rec.cylind.h. stzn,m4x40	61761	
13	Fuse T2AH / 250V, 5x20mm	511200	

Item	Description	Order No.	Replaced by
14	Screw-cross rec. c/s h, stzn, m3x6	61620	
15	Screw-cross rec.cylind.h. stzn,m3x20	61737	
16	Shakeproof washer m3.2	63611	
17	Fan unit (side), F-CM1	896564	
18	Filter (side fan), F-CM1	896085	
19	Filter bracket (side fan), F-CM1	896086	
20	Side frame unit, F-CMREC1, rev. 04	M1029322	
21	Connector board PMB-REC, F-CM1	896894	
22	Screw of D25 connector, F-CM1	897531	
23	Power cable, F-CM1	898313	
24	PMB-connector board, F-CM1	898108	
25	Battery-NiMH,12V,3.5Ah,10x1.2V	17014	
26	Bottom plate, F-CM1	8001365	
27	Washer-spring, M3,STZN(FZB),DIN127	634101	
28	Power management board, F-CM1	8003808	8005308
29	Spacer, hexagon bar, M3X8,5AV5MSN	640459	
30	Module mother board, F-CM1	8000426	
32	FRONT PLATE (FRAME), F-CM1	896087	
37	BOTTOM INSULATOR, F-CM1	M1034048	
	Recorder, Thermal plott.forREC,50,seril.76.8kB	90350	

3   Software licenses

Description	Order No.	Note
Service Software, anesthesia	S-00A05S/S-00A06S*	
Service Software Licence, anesthesia rekord keeping	L-00A07S/L-00A08S*	
Service Software Licence, anesthesia	L-CANE02(A)S	
Service Software License, anesthesia	L-CANE03..02(A)S	
Service Software License, anesthesia	L-CANE03..03(A)S	
Service Software Licence, anesthesia	L-CANE05(A)S	
Service Software Licence, critical care	L-CICU05(A)S	

*)The software S-00A06/S-00C04/L-00A08 includes extended bedside arrhythmia analysis.

4   Upgrade Kits

Description	Order No.	Note
Datex-Ohmeda S/5™ Network and MemCard Upgrade	U-CMMEM	
Datex-Ohmeda S/5™ Network Upgrade	U-CMNET	
Datex-Ohmeda S/5™ Wireless LAN Upgrade	U-CMW	
Datex-Ohmeda S/5™ Recorder Upgrade	U-CMREC1	